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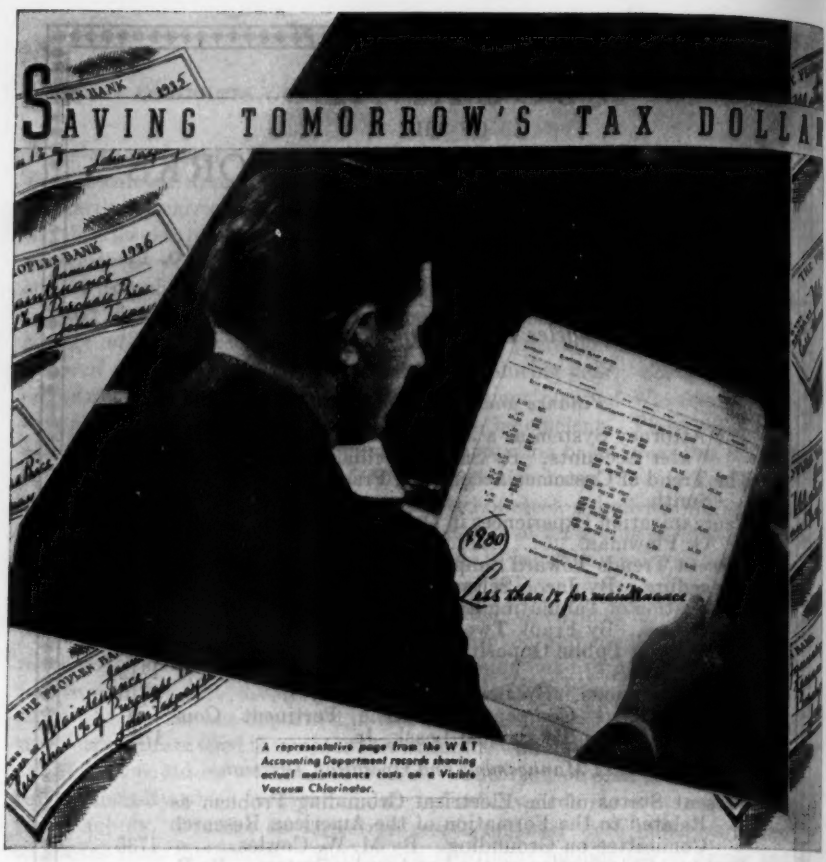
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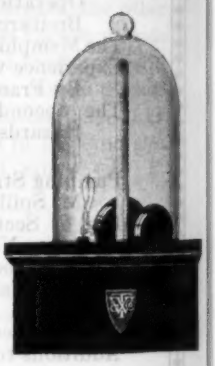

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Vol. 28 NOVEMBER, 1936 No. 11

THE ATTORNEY SYSTEM AS A MODERN METHOD OF COLLECTING WATER ACCOUNTS

By Samuel William Zerman

(*Master in Chancery and Counsellor-at-law, Weehawken, N. J.*)

It is my thought that perhaps the most adequate introduction to an article of this nature, is to illustrate by an actual case history, just how the "Attorney Method of Collecting Delinquent Accounts" operates.

I have selected from our files, one particular case which I felt would be interesting, in that it deals with the most strenuous objection raised against the system, since it was adopted by the Hackensack Water Company some seven years ago.

About a year or so after the system was instituted, a gentleman whom I shall refer to as John Smith, complained to the New Jersey Utility Commission because the Water Company had instituted suit against him to collect a small bill, which he claimed to have delayed paying, through an inadvertence.

Mr. Smith concluded his letter of complaint as follows:

"My purpose in writing your department is to learn if there is some way of bringing moral suasion to bear on a situation of this kind. *Is there nothing which can be done to compel this Water Company to use the methods of non-monopolistic companies in the collection of their obligations?* (Italics mine.) Is this company privileged to ride rough shod over the public, thus submitting all its customers to the inconvenience which even minor meddling in legal matters creates?"

An investigation was ordered and the following illuminating facts were brought out.

In the usual course of business, the Company had mailed a quarterly bill to Mr. Smith, which was commensurate with the normal charge for such a period, being slightly more than $3.00, an average of about four cents per day.

At the end of thirty days, no payment having been received, the Company sent a statement, setting forth its policy with respect to collections, including therein the following paragraph:

"You may be assured that we will appreciate very much your informing us if there is any reason why the account should not be paid."

This statement did not bring payment or even a reply. The account thereupon was turned over to the attorney of the company, who approximately six weeks after the bill was rendered, wrote a letter to the delinquent customer requesting payment within the next seven days. Mr. Smith was advised in this letter that if he would give some reason for non-payment, he would be shown every consideration. There was also a reminder that court costs would accrue if it were necessary to start suit. Still no word from Mr. Smith.

Suit was therefore instituted some 20 days after the attorney's letter was sent, and more than two months after the original bill had been mailed. At the time, Mr. Smith had been supplied with water service for a period of nearly five months, for which he had made no effort to pay, nor had he deemed it necessary to explain his failure to do so.

It was only after an officer of the court had served a summons at his home that a check for the amount of the water bill was sent. Since the legal court charges were not included, the company's attorney returned the check. Our friend Smith thereupon indignantly paid the court charges and brought the matter before the Utility Commission and the public press, thus causing considerable furor before the true situation was finally disclosed.

It developed that Mr. Smith had been far from regular in meeting his water charges. He took six weeks to three months from the date bills were mailed to make payments. As a matter of fact, in the quarterly period prior to the one under consideration, it had also been necessary to refer this account to the company's attorney. However, on this occasion, he had requested and received an extension of two weeks.

All of which brings me back to the concluding paragraph of Mr. Smith's letter to the Utility Commission. If you will recall, in this paragraph he maintained that something should be done to compel this water company to use the methods of "non-monopolistic" companies, in the collection of its obligations.

Had Mr. Smith been less intent upon attempting to discredit the company, and had he spent some time in reflection, he perhaps would have realized that the method used to collect his account was precisely that which the so called non-monopolistic companies use.

Why? Because "non-monopolistic" companies cannot enforce the collection of customers' obligations by any other means than by instituting suit. A denial of credit, where there are similar organizations prepared to supply the same commodity, would merely result in a transfer of patronage.

On the other hand, it is apparent that the reason "monopolistic" companies customarily obtain payment by discontinuing service, is because there is no other way for the customer to obtain that particular necessity.

It is therefore obvious that a utility, enjoying a monopoly, which instead of discontinuing service, uses the courts for collection, is depriving itself of an advantage over the customer. It places itself upon the same plane with any other business enterprise, which having sold its product, is entitled to be paid within a reasonable time, and after such reasonable time has elapsed, is entitled to use our courts in an effort to secure payment.

Of course, injudicious handling of the various types of cases would tend to destroy the most carefully devised plans. Since the method of procedure is of such importance, it might be well at this point to further elaborate upon the Hackensack Water Company system, which I have touched upon in discussing the case of Mr. Smith.

THE HACKENSACK WATER COMPANY SYSTEM

The Hackensack Water Company serves approximately 51 municipalities in Bergen and Hudson Counties, located in the northeastern part of New Jersey. The territory is bounded on the east by the Hudson River, which separates that portion of the state from the City of New York. The boundary line on the north is New York State, and on the south the cities of Jersey City and Hoboken. The population in this area is close to 400,000 and the number of accounts

is approximately 75,000. The amount of water used daily is over 33,000,000 gallons.

With certain exceptions, accounts are billed quarterly, under a cycle system of daily reading and billing. All bills are payable upon presentation. In addition to its six commercial offices the company has arranged for convenient payment at 26 neighborhood banks or real estate offices in the area served. The company does not send out collectors.

Customers are classified according to their records for payment. The great majority pay their bills without solicitation. They, of course, present no problem. A very small minority are absolutely without means. Since their number is small, it is possible to give them special treatment, providing the company is able, by means of tactful investigations or through the agency of relief organizations, to ascertain their true financial condition.

Having eliminated those who pay within a reasonable time and those who are unable to pay, the company reserves its collection procedure for those who for reasons too numerous to relate, simply will not arrange their affairs in such a manner as to meet their just obligations, unless pressure is brought to bear.

It is this latter class which causes difficulties for the collection department. How to compel them to pay without prejudice to the friendly relations which a company endeavors to maintain with the general public, is a problem which the Hackensack Water Company attempts to solve in the following manner.

Thirty days after the bill is rendered, a statement is sent. If this statement does not produce results within seven days, the account is turned over to the company's attorney. The latter sends a letter, framed in conciliatory language, to the delinquent customer advising him that the company is endeavoring to effect payment within a reasonable time, and assuring the co-operation of the attorney's office in adjusting any dispute. The letter requests a reply or remittance within seven days, but makes no actual threat of suit.

If customers request additional time to pay, the matter is taken up with the various district supervisors of the company. Every letter is courteously answered, whether the request for an extension of time is granted or not. When the request is refused, the reason therefor is given. Telephone calls are given the same attention. Every effort is made to assist the customer in avoiding suit.

If no reply is received to the attorney's letter, and if payment is

not forthcoming, action is started within a period of time ranging from one to three weeks. As a final precaution, an investigation is made before suit. The investigator seeks a personal interview, to determine, if possible, the reason for non-payment and to repeat the attorney's message. The company's subsequent action may be influenced by the investigator's report.

Where, however, these contacts have produced no satisfactory results, and it is necessary that suit be brought, actions are usually instituted in the Small Claims Division of the various District Courts in the territory. The jurisdiction of these courts is $50.00 or under. Suits for amounts over $50.00 are started in the regular division of the District Court, which has a jurisdiction up to $500.00.

Lists of actions which are instituted, are sent to all the company offices. Once suit is instituted, and the costs, averaging about $2.00, have been paid to the court, no payments are accepted from customers unless the court charges are included. However, in some cases, under exceptional circumstances, the costs are waived.

Proceedings in the Small Claims Court are very informal. Parties to an action may act as their own attorneys. Each case takes but a short time. Generally, the entire list of causes is cleared up in a single morning. It is thus possible to have a hearing within a week or ten days after suit is started, at which time judgment may be had upon proof of the amount due. There is rarely a valid defense.

Where it is necessary to take judgment, the company usually does not follow up with any supplementary legal proceedings for collection. A letter is sent advising the customer of the judgment, and further stating that under the circumstances, unless the full amount due is paid, further credit will be denied and the service discontinued.

It will be observed that the above system provides for a bill and three subsequent notices before suit is instituted. There is ample time for a customer to make known his financial condition if he is unable to pay. It gives him a chance to contact various relief organizations, which in turn can get in touch with the company. The success of such a system depends greatly upon the consistent regularity of its synchronous operation as part of the billing procedure. This is not difficult of attainment.

As stated by the New Jersey Utility Commission in its opinion in the "Smith" case,

"This Board cannot deny a utility the right to use the courts of this state for the collection of any bill due the company. This method should work less

hardship upon the customers of the company than the former practice of discontinuing service for non-payment, especially since the company will grant any customer an extension of time for payment if requested to do so. Since the customer receives several notices prior to the institution of suit, and the company's established policy provides for the granting of extensions of time for payment on request of the customer, no customer need subject himself to a law-suit for the collection of his account."

This citation answers the criticism which might be raised that, if a customer finds it difficult to pay his bill, why subject him to additional court charges? Liberal extension of time is provided for, and if a party is without funds, the least he can do is to inform the company. In such an event, special consideration will be given.

Furthermore, court action results in only a small number of cases. Usually the attorney letter is sufficient to bring about payment. During the past five years, the records show that suit was started in only 8 percent of the total number of delinquent accounts handled.

Another criticism has been that, since the system does not contemplate further legal action to enforce payment of the judgments which are obtained, it is eventually necessary to revert back to the old shut off method. A sufficient answer seems to be contained in the record.

According to statistics at hand approximately 1,252,725 bills were sent during the five year period previously mentioned. Of that number 102,851 delinquent accounts were referred to the attorney's office. A total of 8,913 suits were instituted; or as previously stated, slightly more than 8 per cent of the total number of delinquent accounts, and only $\frac{7}{10}$ of 1 percent of the total number of bills sent.

On or before the date judgment was obtained, some 5 percent more of the outstanding accounts were paid. A small number of those still remaining unpaid, represented suits for final bills of customers no longer receiving water service, thus leaving about 2,821 accounts to recommend for discontinuance of service at the conclusion of the legal procedure. This was less than 3 percent of the number of delinquent accounts handled and $\frac{1}{3}$ of 1 percent of the bills sent. Instead of some 400 letters per week, advising a possible denial of service, the company sent an average of but 11.

Another answer to the criticism suggested above is that by first instituting suit, the danger of illegally or erroneously discontinuing service is avoided, as for example in cases where payment has been

held up pending the settlement of some bona fide dispute between the customer and the company.

No claim is made that this system will prove satisfactory in every case. No method of collection has yet been devised which will please everyone. Most complaints received, however, have been without merit. A tactful letter or, in some extreme cases, an interview in which the system is fully explained, seldom has failed to result in a better understanding. Cases like that of Mr. Smith are a rarity. On the other hand, letters like the following are not unusual.

———— St.,
North Bergen, N. J.
December 8, 1935.

Samuel W. Zerman,
624 Park Avenue,
Weehawken, N. J.

Dear Sir:

We are sorry that we did not make payment sooner, but due to financial conditions, we were unable to do so.

We appreciate the pleasant manner in which you ask for our remittance.

We hope you could please be patient until Saturday, December 14. Our payment will be in before noon.

Very truly yours,
(Signed) ————————————.

A collection system which elicits a letter of the above type is a forward step in the direction of improved public relations between consumer and utility. Certainly it seems superior to the time worn collector and shut off method, in reference to which an article in "Public Service," as far back as May 1910, commented as follows:

"In the matter of handling delinquent accounts public utility companies appear to have made little or no progress during the last twenty-five years. When a consumer does not pay promptly, he usually receives a notice calling his attention to the fact; then if he overlooks making a settlement, another notice is sent to him, stating that service will be cut out on a certain date if he fails to "come across" with the cash.

"Of course, this method works well in one respect. It reduces the proportion of uncollectible credits to a very small minimum. Probably no line of business suffers less from bad debts than gas and electric, telephone and water companies. But getting the money is not quite everything—although it must be admitted that it is important enough.

"In our opinion, the peremptory shut-off notice is one of the crudest means of securing the payment of delinquent accounts. It smacks of the loan shark,

the old style installment house and the horde of petty traffickers who insist upon their pound of flesh and usually, in the end, obtain satisfaction just about as substantial and comforting as that received by the immortal Shylock."

A method of collections through the courts, intelligently administered, so as to provide for proper investigation and personal contact; which provides for a reasonable credit period to make such contacts; which permits of certain flexibility in the treatment of each account while still functioning in a systematic manner; is surely not subject to the criticism contained in the above quotation. Further, within the experience of this company, its effect is cumulative in facilitating collections throughout the territory without the dreary repetition of visitations with a curb key.

Such a method I believe is progressive, businesslike and humane, and is a practical and efficient solution of the problem of how to deal with delinquent accounts.

THE TREND OF CUSTOMER ACCOUNTING PRACTICE

By Hal F. Smith

(*Department of Water Supply, Detroit, Mich.*)

To the writer was assigned the task of finding the answer to the question "Is it a fact that there is a tendency to change back from the stub plan of customer accounting to some form of the ledger plan?"

It was evident from the outset that in order to answer this question, it would be necessary to determine not only what plans are in use at the present time and the relative popularity of each, but also to determine what is in the minds of the managements of at least a representative group of utility companies throughout the country. To secure this information, a brief questionnaire was designed in which four questions were asked, in addition to those necessary to make proper classification of reporting companies possible. These questions were:

(1) What customer accounting plan do you now use?

(2) What customer accounting plan did you use prior to the adoption of your current plan?

(3) What plan would you prefer if you were to install a new system today?

(4) Do you believe that there is a tendency to change back from the stub plan to some form of the ledger plan, and if so, why?

Two hundred and ninety-five of the largest utilities in the country were then selected, paying particular attention to see that all sections of the country were represented. These utilities included municipal water departments, private water companies, gas companies, electric companies and combination companies, furnishing two or more of the above mentioned services. Questionnaires were then mailed to this group. Returns were received from 194 companies and are shown in table 1.

The promptness in which these returns were made and the evident care that had been taken in filling them out, together with the numerous requests that were made for copies of the completed report, indicated a great deal of interest in this question.

Tabulation of these returns is shown in table 2.

This tabulation shows that in the past there has been a decided trend away from the ledger plan toward the stub and register sheet plans, and further, that the trend in that direction has stopped. That is about all that can be said of the trend up to the present time, for at this point we leave what has actually been done and concern ourselves with what is in the minds of the managements of the various reporting companies.

We consider therefore, that the tabulation of the third column is not so much indicative of the present trend as of the probable future trend. The tabulation shows that while 81 of the reporting companies are now using the stub plan, only 77 prefer it, thus indicating

TABLE 1

CLASS OF UTILITY	NUMBER OF COMPANIES REPORTING	NUMBER OF METERS REPRESENTED BY THE GROUP	NUMBER OF CUSTOMER ACCOUNTS REPRESENTED BY THE GROUP
Water—municipal, having right of lien	32	1,418,754	1,591,037
Water—municipal, not having right of lien	32	1,350,210	1,892,127
Water—private	8	246,680	289,258
Gas	32	5,380,181	5,167,408
Electric	31	6,307,562	6,079,398
Combination	59	12,563,033	12,009,408
Totals	194	27,266,420	27,028,636

that four of these companies would change to some other plan, if they were to install a new system at this time. Likewise, the register sheet plan has apparently lost one advocate, while the ledger plan has gained four. Included in that section of the tabulation headed "Some Other Plan" are all those that for various reasons could not be placed in any of the other three divisions. While this tabulation indicates that only five of the reporting companies have expressed a desire to change to some other customer accounting plan than they are now using, this is not quite the fact, as only net figures are shown. While it is true that the majority of reporting companies indicate that they are satisfied with the plan that they are now using, there are, however, 17 companies which report a desire to change from their current plan.

TABLE 2

Tabulation of returns

CUSTOMER ACCOUNTING SYSTEM	CLASS OF UTILITY	PRIOR: Number of reporting companies using customer accounting plan here indicated prior to adoption of current plan	CURRENT: Number of reporting companies now using plan here indicated	PREFERRED: Number of reporting companies expressing preference for plan hereindicated if they were to install new system today
Stub	Water—municipal—lien	0	7	6
	Water—municipal—no lien	4	10	13
	Water—private	0	4	4
	Gas	1	16	14
	Electric	3	16	14
	Combination	5	28	26
	Total	13	81	77
Register sheet	Water—municipal—lien	2	3	2
	Water—municipal—no lien	1	2	1
	Water—private	2	1	1
	Gas	1	5	6
	Electric	3	4	4
	Combination	1	10	10
	Total	10	25	24
Ledger	Water—municipal—lien	27	21	23
	Water—municipal—no lien	26	19	17
	Water—private	6	3	3
	Gas	29	9	9
	Electric	22	8	10
	Combination	47	12	14
	Total	157	72	76
Some other plan	Water—municipal—lien	3	1	1
	Water—municipal—no lien	1	1	1
	Water—private	0	0	0
	Gas	1	2	3
	Electric	3	3	3
	Combination	6	9	9
	Total	14	16	17
Proof total		194	194	194

It is therefore evident that whatever trend is indicated at this time, must be based upon these 17 companies.

The plan now used by these companies and the plan they would prefer to be using are shown in summary below.[1]

Stub Plan:	Lost 9, gained 5.	Net loss 4
Register:	Lost 4, gained 3.	Net loss 1
Ledger:	Lost 4, gained 8.	Net gain 4
Some Other Plan:	Lost 0, gained 1.	Net gain 1

While the change is relatively small, it is nevertheless apparent that both the stub and register sheet plans are losing in popularity, while the ledger plan is gaining. It is interesting to note at this point that table 2 shows that the tendency to get away from the stub plan is indicated by four of the six classes of utilities here considered; namely, municipal water departments with lien rights, gas companies, electric companies, and combination companies, with only the municipal water departments without lien right indicating a tendency toward further adoption of the stub plan, and private water companies indicating no desire for change in any direction.

The forth question in the questionnaire is "Do you believe that there is a tendency to get back to some form of the ledger plan, and if so, why?" Answers to this question, of course, cannot be tabulated, and for obvious reasons we cannot here report all the answers given by the 194 reporting companies, interesting as they may be. We have, however, selected a number of them, which we believe, represent the two opposing lines of thought as expressed by the entire group. These replies are shown below and are grouped for convenience sake in the following manner:

(1) Those that favor the stub or register sheet plan.

(2) Those favoring ledger.

An Eastern gas and electric company of 905,202 customer's accounts, reports as follows:

"Do not believe that there is any great tendency towards return to the ledger plan. What tendency there is, in my opinion, is caused by the setting up of history record files to accumulate information which formerly was secured from the ledger sheet. There is no doubt that if such a file is deemed necessary, the expense of it largely offsets economies realized from the installation of a stub or other modified plan."

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[1] All of these 17 companies cannot be located in table 2 because there net figures only are shown.

A municipal water department, whose charge is a lien against the property, and which has 96,000 accounts, reports as follows:

"The stub plan has been so satisfactory that we would not change back to the cumbersome ledger plan."

A municipal water department of a southern state, whose charge is not a lien against the property, and which has 73,000 accounts, reports:

"We do not believe that there is a tendency to get back to the ledger plan. The stub plan has so many advantages, a few of which are; (1) flexibility; (2) easy and speedy operation; (3) ability to note visibly the status of collections."

A gas company of the Middle West, with 850,000 accounts, reports as follows:

"Insofar as my experience goes, the tendency is not away from the so-called stub plan of customer accounting in utility companies. In our case, the ledger plan would increase the cost of keeping customers' accounts in excess of $100,000.00 per year, and in my opinion that is a representative condition in most utility companies."

Another gas company of the Middle West of 154,000 accounts, reports:

"There appears to be no such tendency in our company. It is probable that some companies favor returning to some form of ledger sheet control to replace the stub plan because of difficulty in preparing itemized bills, showing dates and amounts due on monthly arrears accounts, which have accumulated during the period that relief agencies have been making payments of current bills. There is considerable reference work necessary to accomplish this under the stub plan of accounting."

A combination gas, electric, and water company of the Southwest, of 50,832 accounts, reports as follows:

"We do not believe there is any tendency to get back to the ledger plan, at least not for companies serving many small communities. The stub plan provides control of accounts receivable in each community with centralized billing by machines, enabling such companies to economically handle their billing and at the same time improve public relations by keeping the customer's account in the office where he pays his bills."

An electric company of one of the Central States, with 83,500 accounts, reports:

"We do not know the tendency, but see no good reason to revert to the ledger plan. We do, however, carry all arrears items on meter reading sheets, this record showing the status of customers' accounts at meter reading dates."

A municipal water department on the Pacific Coast, whose charge is a lien against the property, and which has 87,000 accounts, reports as follows:

"Although there have been many recommendations and suggestions from accountants, experts, and others that we discard our ledger plan, I am of the firm opinion that the proper method of maintaining utility accounts is by the ledger plan and particularly at this time and during the past years of depression where it was so essential that a complete record and history, which would be immediately available, be kept of each individual account.

"Usually, where other than the ledger plan is in use, a history-record-card of each account is also carried—where the ledger plan is used, this record-card is unnecessary as the information desired can be kept on the ledger sheet.

"Where water rates become a direct lien against the property, and where the consumer is not held liable for the water bills, I believe that a permanent record, such as the ledger sheet which could be termed as a docket or lien book where a complete record of the account can be maintained, is very essential.

"I am informed there is quite a tendency to get back to the ledger plan of handling utility accounts both by the private and municipally owned plants."

A municipal water department of the Middle West, whose charge is a lien against the property and which has 14,000 accounts, reports as follows:

"The individual ledger card which we previously used, has the advantage of assembling all information as to previous bills, etc., on a single card and there is considerable question as to whether the stub plan and register plan is faster in any respect. We are now using the register sheet plan, but if we were to install a new system today, we would prefer the ledger."

A municipal water department of the Southwest, whose charge is not a lien against the property and which has 20,000 accounts, reports as follows:

"We do not think there is any tendency to get back to the ledger plan. However, will say that we changed from the ledger system to the stub system, which we found would not give sufficient information, and have since changed back to the ledger plan, which proves very satisfactory."

A municipal water department of 165,000 accounts, and whose charge is not a lien against the property, and which changed from ledger to the stub plan and is now back on the ledger plan, reports:

"We do not know whether there is a trend to go back to some form of ledger plan, but we find it advantageous to us to have a record of each account before us, covering several billing periods. This record is complete for meter readings, water consumption, cash receipts, discounts, refunds or adjustments. Under the stub plan system, this information is not available in compact form. When we were operating under the stub plan, our meter book was our only source of information, relative to water used and amount billed. When the meter book was in the field, our only recourse was to request the consumer to call again for the information desired."

A gas company of the New England States, with 60,000 accounts, reports:

"It is believed that there is a tendency towards some form of the ledger plan because in effect, it provides a historical record for each customer, the need for such a record becoming increasingly important from the standpoint of credits, collections and public relations. We are now using the stub plan, but if we were to change today, we would prefer the ledger plan."

An electric company of the Middle West, with 65,000 accounts, reports as follows:

"We believe there is a tendency to get back to the ledger plan and that it is caused in part on account of the stub plan not lending itself to make readily available analyses of accounts of customers for periods considerably prior to the current month. While such analyses may often be worked out from meter index records, there is no specific record that can be referred to for this information under the stub plan. We are now using the stub plan, but if we were to change to a new system today, we would prefer the ledger plan if we could be assured that it could be handled for the same relative expense."

An electric and gas company of the Southeast, having 149,000 accounts, reports as follows:

"The advantages afforded by the ledger plan for customers' accounting records have been brought to light on several occasions since our adoption of the so-called stub plan. The ledger plan provides a ready historical record of customers' accounts not provided by the stub plan. The lack of this historical record has been the source of considerable inconvenience at times. While the ledger plan is not as flexible as the stub plan, we believe it has sufficient merit to justify a thorough consideration of its adoption should any change be contemplated. The tendency to get back to some form of ledger plan seems to be general, and in our particular case, we lean to some such plan in preference to the stub plan because of the historical record of the individual's account so readily available.

"We have made a study of this subject and are considering the adoption of a ledger-card record. However, we do not plan to make any immediate change in our system of customer accounting."

A municipal water department of the Central States, which has 274,000 customers' accounts, comments as follows:

"We do not know what the trend is, but if there is a tendency to return to the ledger plan, we believe the reason is this:

"In the first place, there seems to be no question but that the most enthusiastic advocates of the stub or register plans will agree that these plans do not produce as satisfactory records as the ledger plan, but they do claim that this disadvantage is more than offset by the economy of operation of the stub plan.

"We investigated these plans quite thoroughly before adopting the combined bill and ledger card plan and came to the conclusion that the companies using the stub plan were either having trouble because of insufficient or unavailable records or had added to the original set-up, auxiliary record systems, such as the history record card and other devices that would in the aggregate give all the information that is normally shown on a ledger card. By the time all of this is done, however, it appears to us that the economy feature of the stub plan has been lost. The addition of these auxiliary record systems seems to prove that all the information normally carried on ledger cards is necessary and if that is the case, a pertinent question seems to be 'Why not have the ledger system in the first place and enjoy the advantage of having all information concerning an account centralized in one place?' "

Several of the reporting gas companies referred your investigator to the 1935 report of the Customer Accounting Committee of the American Gas Association. A copy of this report was secured, together with a statement from Mr. John A. Williams, Auditor of Commercial Accounts of the Niagara Hudson Power Corporation and a member of the committee referred to. Mr. Williams has kindly given us a brief of their report, insofar as it refers to the question now under discussion.

Mr. Williams' statement follows:

"Regarding your last question as to the trend back to the ledgers, there does seem to be some inclination of various companies to go back to ledgers. I do not think, however, that this trend has assumed any large volume in the gas and electric companies as yet. A committee, of which I was a member, prepared a paper on this and related subjects last year for the American Gas Association. We received replies from ninety companies and of these ninety companies only about 10 per cent were then using ledgers whereas in 1925 about 70 per cent of the same ninety companies were using ledgers. We did find, however, that about 40 per cent of the companies are now maintaining a separate history record and I imagine a number of these companies will be giving consideration to returning to the ledgers if thereby they can eliminate the cost of maintenance of the separate history record files."

Considering the fact that we are attempting to determine a tendency rather than a definite trend, and realizing that tendencies may

be indicated by less tangible evidence than trends, we believe it worth while to mention one more point. It is this:

After reading the comments of the 194 reporting companies, an impartial observer will, it is believed, get the general impression that the users of the stub and register plans are defending them rather than advocating them and that their composite thought with but few exceptions, would boil down to something like this:

"The stub plan is all right, *but* . . ."

while the composite thought of the ledger users seems to be:

"The ledger plan meets our every need."

Considering this apparent underlying thought, intangible as it is, together with the tangible results of the tabulation of returns and definite statements made by the reporting companies, together with the findings of the American Gas Association Committee, it appears that while no marked trend back to the ledger plan is yet under way, there is a tendency in that direction.

REORGANIZATION EXPERIENCES IN DENVER, 1933–1936

By E. G. Plowman

(Former Executive Assistant, Board of Water Commissioners, Denver, Colo.)

Contrary to popular belief among water works executives, it is possible for a municipal water utility to go through a reorganization for service and efficiency, not political reasons. This has been the recent experience of the Denver water utility, completely reorganized solely to improve efficiency and service to the public.

To understand how this could come about, it is necessary to review some of the history of the Denver Municipal Water Works. This history began in 1874, with the formation of the first of a number of competitive water companies, finally merged in 1894 into the Denver Union Water Company.

From 1894 to purchase by the city in 1918, the private water company operated efficiently and, in general, effectively. Beginning in 1910, however, this private company engaged in a continuous legal battle with the city over the terms of purchase, renewal of its franchise having been refused by the voters in that year. Thus while the company remained efficient down to its transfer to the city in 1918, the incentive to be progressive was not present after 1910.

A single illustration will suffice. The Denver Union Water Company, the East Bay Water Company of Oakland, and the Spring Valley Water Company of San Francisco were for some years the largest surviving private water utilities in the western part of the United States. Their executives visited each other's plants and were in touch with developments. The Denver company, therefore, must have been aware of the progressive experimenting of the East Bay Water Company, beginning in 1916, with punch card methods of billing and accounting. The Denver company, however, continued the use of bound books, and of penwritten bills torn from such bound books as prepared, down to the transfer to municipal ownership.

This decade of efficiency without substantial progress, of course,

left its mark on the physical plant. The municipal Board of Water Commissioners, installed in 1918, soon learned that Denver was a rapidly growing city with a dozen low pressure areas due to small pipe; with several portions of the city still served by shallow contaminated wells; with fire protection problems; and with wooden conduit lines barely able to handle the maximum load of summer irrigation use of water. Above all, the new Board after a few years became absorbed in the paramount problem of developing supplemental water supplies by expensive diversion from Colorado River source streams by means of transmountain tunnels.

From 1918 down to 1936, therefore, the emphasis in the public mind and with the Water Board has been on solution of pressing problems of physical development of the water system. The Water Department would no sooner get settled down than it would be projected into some kind of crisis or reorganization having to do with physical development. The following brief chronicle will illustrate the overshadowing importance of this factor:

November, 1918 to August, 1919: The first Water Board tried the experiment of operating without a salaried Manager. Problems began to pile up, chiefly demands for physical improvements.

August, 1919 to May, 1921: The Water Board, in August, 1919, appointed as its first salaried Manager the retiring Mayor, and he soon became the leader of a campaign for a $5,000,000 Improvement Bond Issue. Blocked by the City Council in 1920, this proposed Bond Issue was defeated by the voters in May, 1921.

May, 1921 to May, 1923: Defeat of the Bond Issue resulted in a campaign for abolition of the Water Board, which plan was rejected by the voters at a special election in October, 1922. Based on a thorough report, in late 1922, of an Engineering Board of Review, the voters approved a $6,500,000 Improvement Bond Issue in May, 1923.

May, 1923 to May, 1925: The Water Board, in June, 1923 was given a new majority of three out of five members. The plan of a salaried Manager was again abandoned until September, 1924, when one of the Board members resigned to become salaried Manager. The $6,500,000 Bond Issue was expended, and the voters, in May, 1925, rejected another $10,000,000 Issue of Improvement Bonds.

May, 1925 to March, 1926: For the first time, attention seemed to be turned largely to matters of efficiency and reorganization. In January, 1926, a newly appointed Board majority took office and promptly took vigorous steps towards internal improvement. Unfortunately, this new Board group resigned in March, 1926, according to press reports because of differences with the Mayor over policy towards the proposed Moffat Tunnel transmountain diversion water supply.

March, 1926 to June, 1926: For over two months, the Water Department was without a head, there being only two Water Board members, not enough to transact business.

June, 1926 to April, 1928: Major emphasis continued to be on the leasing of the Moffat Water Tunnel, to develop a supplemental water supply. During 1928, the Board again operated without a salaried Manager, then appointing as Manager a long service employee, who continued to be Secretary of the Board. In April, 1928, the Water Board raised rates about 17 per cent to provide construction funds for needed physical improvements.

April, 1928 to August, 1932: Moffat Water Tunnel and much other needed improvements construction was launched on a large scale, with the funds provided by the increased rates. In August, 1930, the Water Board appointed as salaried Manager one of its own members who resigned for the purpose. This Manager was a competent Construction Contractor. In May, 1931, the voters refused to reduce water rates by Charter Amendment. In August, 1932, the Water Board voluntarily rescinded the rate increase of 1928.

August, 1932 to April, 1936: Under the restored lower rates, the emphasis rapidly changed towards more attention to internal reorganization. In May, 1933, the voters again refused to abolish the Water Board. After August, 1933, the position of Manager was again non-existent, its place being taken by the salaried post of Executive Assistant to the Board.

It is obvious that the fifteen major changes or attempted changes in Water Board policy, organization or method of top management, taking place in a little over fifteen years, scarcely encouraged internal improvement of office and operating practice. The truth is clear from the record, that the Water Board, the Mayor and City Council, and the public were concerned chiefly with the paramount questions

and problems of physical improvement and extension of the water plant.

Evidence of the gradually widening gap between good practice and the development of Denver office methods is found in the continuous conflict between the City Auditor and the Water Board prior to 1932. These disputes with the City Auditor covered such subjects as establishment of sinking funds; establishment of depreciation accounting; clearing of funds and records of a Water Board subsidiary corporation through the City Auditor and City Treasurer; improvement of billing and accounting methods; filing of contracts before work had actually begun; and annual auditing of the Water Fund by Certified Public Accountants.

A similar gap has tended to exist on the operating side of the utility, lessened of course by the fact that the physical improvements brought with themselves many related operating developments. In 1933, a regular program of approximately annual testing and checking of the 14,500 street valves was begun. In 1934, service cars were equipped with police radio receivers, and began to respond to fire alarms to service fire hydrants. In 1935, the Water Board approved its first Main Extension policy, ending the future laying of private pipes in city streets. These few illustrations indicate some lag in operating practice, despite the stimulus of improvement expenditures.

REORGANIZATION PRINCIPLES AND PRACTICE

In any reorganization, the first decision must be with respect to basic organization. In the Denver case, it was decided to rebuild the executive organization along functional lines. This has proved successful, the following advantages having appeared:

1. The functional type of organization meshes properly with the legal functionalization imposed by the Charter, which has made the City Auditor, City Treasurer, and City Attorney responsible for appropriate water utility work.
2. It has solved the vexing problem of preparation for and conduct of Board meetings. The seven functional "managers," meeting as a committee, prepared the Board meeting agenda. Operating problems are then submitted by the appropriate manager to the Board in advance of the meeting. The functional "managers" attend the Board meetings and stand

ready to answer Board inquiries concerning recommendations.

The second problem attacked was the budget. Transferance to the City Treasurer of debt service in twelve equal monthly installments, instead of waiting for "peak" payments in particular months, has simplified the general budget of monthly income versus total expense.

After three experimental budgets constructed in 1933 and 1934, the Water Department has operated, since early 1935, on a fully budgeted basis. Modelled in part on the form used by Dallas, Texas, the budget is carried out in detail by work type; expense classification; personnel required; and by months. It was developed after consultation with all of the superintendents, as well as with the functional "managers." Control has been obtained chiefly through a monthly meeting of superintendents and managers. At this meeting each item of the monthly report is taken up, over-runs discussed and under-runs praised.

The Water Board has also found valuable a daily report of unencumbered cash, that is, of cash on hand after subtracting warrants issued and the current month's requirements for debt service. This report has enabled the Board to plan its actual expenditures for construction to be charged to the current surplus as maintenance, depreciation or improvement. The minor construction budget, planned at the beginning of the year, is executed as funds become available and appear as unencumbered cash.

Adoption of the obvious procedure of dividing the 65,000 schedule license bills into three equal parts, so that one-third of the quarterly bills are sent out each month has reduced the former peak loads on the billing group and on the cashiers. Another decision that might likewise seem to be over-emphasizing the obvious that gave good results, was to rearrange the office layout so that clerical workers were not watched and hailed by customers hunting for adjustment "short-cuts." This made possible concentration of customer complaints, as well as handling of large groups of accounts, in a specialized division of the office.

Billing, collecting and accounting were placed together, under one functional manager, and employees specialized on typical jobs, wherever possible. An afternoon and early evening shift of office employees was established to check receipts. This group also removes from the files unexecuted turn-offs, so that delinquent

customers paying late in the afternoon are not annoyed by the turn-off man next day.

After much study, the punch card system of billing was adopted for the schedule bills, for the following reasons:

1. Once the master punched card record has been created, and matched with the addressograph plates, the customer must receive the correct bill, automatically adjusted for the summer added irrigation charges. The Water Board is able to audit its income, starting with the total amount on the schedule books, and accounting for all vacancy and other credits. Checking of receipts has become almost fool-proof.
2. The punch card bill has made it possible to give the customer considerable detail concerning the actual billing base for his own premises. The machine puts right on the face of the bill, along with the charges and credits, such information as the number of feet of lawn irrigation charged; the number of rooms charged; the number of automobiles, baths, etc., forming together the billing base.

Improvements have been made in control of inventory and shops. The accounting division has appointed a travelling representative, who checks the actual inventory at every operating point once a year. This has reduced the practice of charging out in excess of needs, and has returned much "charged-out" stock to regular inventory accounts. The inventory itself, and all shop operations performed by the Water Department have been concentrated, as far as possible, at one storage yard under one superintendent. The maximum of one thousand dollars has been established as the line beyond which the Water Board's specific approval must be obtained for expenditure for inventory, or for construction "work orders."

The daily expense distribution, including the payroll records, is now posted by machine, replacing former hand work. The punch card machine is beginning to take over mass production portions of the accounting load, such as the inventory records.

The Water Board, in 1935, decided to have the years 1934 and 1935 audited by Certified Public Accountants, the first thorough audit in the history of the Water Department. These auditors found the records for 1935 much better for auditing purposes than those for 1934, and index of the improvement that has been taking place.

In 1933 there were no personnel records worthy of the name. Today the service record of every employee is available, along with

detailed information of special character, such as records of disciplinary action that may have been taken.

Nearly every employee has been transferred in one way or another, during the three years since 1933. This has reduced the bad effect of years of almost no labor turnover, as follows:

1. Old employees who had been blanketing key promotions of younger men stepped aside into less important work.
2. The new methodical pay classification was given the acid test of comparative ability of different individuals cross-transferred, each to the position of the other.
3. Many employees found new interest in their work, and developed multiple skill of value to the Water Department.
4. It became possible to concentrate the reduced "extra list" of part time day pay employees at two operating points.

Since 1933 employee coöperation and activity has been encouraged, resulting in a strong Joint Committee of elected employee representatives and appointed executives; an employee's Credit Union; and divisional Safety Committees.

This general program of reorganization has reduced Water Department operation costs. These savings have been absorbed in various ways, such as the following:

1. The working week has been reduced from about 44 hours average to about 40 hours, only partly offset by pay reductions.
2. A large number of "merit" increases in pay have been made. Service men, clerks, and other classifications have had a senior grade added to provide an increase in pay above the average, reflecting long and valuable experience.
3. All long service employees doing permanent work are now on the monthly payroll, thus giving 350 instead of 250 annual vacations with pay.
4. A formal sick-leave plan has been established for all monthly employees, costing about 1 percent of payroll per year.
5. New debt service costs for completion of the Moffat Water Tunnel amount to about $15,000 monthly additional expense.
6. The unencumbered cash balance has risen from a small red figure in January, 1934, to over $500,000 two years later.
7. Much new work has been undertaken, such as valve checking; accounting controls; water waste inspection; special lawn

irrigation enforcement inspectors; public relations bulletins and advertising. These latter activities were, in part, responsible for reducing 1935 average daily consumption to 153 gallons per capita—20 percent under the previous 17 year average, and over 10 percent under the previous laws in 1925 (176 gallons) and 1933 (177 gallons).

The reorganization that has taken place since 1933 in the Denver Municipal Water Works can best be apraised by quoting briefly from reports made by others than myself in 1931, 1933, and 1936.

The 1931 report, made to the Mayor, and later made available to the Water Board, stated, in part: "but one due date . . . causes a large peak load on the twentieth of each third month . . . work is all done by hand and there is no absolute control on the billing. . . ." This report, by M. F. Hoffman, Assistant Superintendent, Cincinnati Water Department, went on to make excellent detailed recommendations concerning accounting and billing procedure improvements.

The 1933 report, made to the Water Board, covered the entire management problem. It stated, in part, that there had been found in the organization: "overlapping of departments, resulting in decreased efficiency and increased costs . . . lines of authority . . . not clearly defined . . . details (going) direct to the Manager. . . ." This report recommended, in part, that "the Manager ought to prepare . . . information relative to operations (to be) placed before the board . . . each month." and that "the water works should operate under a carefully prepared budget." This report, submitted by the firm of Alvord, Burdick and Howson, closed with a strong recommendation for active public relations work to inform the public concerning the Water Department, its problems and its needs.

In 1936 the Certified Public Accountant firm of Clem W. Collins and Company presented to the Board the audit for 1934 and 1935 together with a requested appraisal of office and accounting methods in actual use. This appraisal, therefore, measures the progress of the reorganization as far as the office is concerned, stating in part:

"The matter of training understudies capable of advancing to other positions in the office has evidently been given considerable thought, and the collection and accounting department seems to be well organized in this respect. . . .

"It is the practice of the accounting department to make a complete detailed budget report monthly. . . . Heretofore a detailed analysis of revenue has not

been made in the budget report . . . we are informed it is the intention to show these details in the budget report beginning with 1936. . . .

"Because of the desire to get the budget report out promptly each month, it is not reconciled with the books . . . the difference will never amount to very much. However, at the end of each year, there should be a complete reconciliation. . . .

"The Board's present classification of accounts is badly out of date. . . . A new classification . . . should be prepared and approved. . . .

"(Staggered billing) has resulted in a considerable improvement in the accounting and collection situation . . . minimum and maximum loads were brought much nearer together. . . . To remedy the (present) defects . . . it is suggested that a true rotation scheme be adopted. . . .

"Under the punch card billing system bills are made for every license number, including vacancies, making it necessary to have properly authorized credits for every charge that is not collected. . . . This is a very important feature of the present system. . . .

"Cashier's lists of cash received are now supported by the stubs that are taken in and the list is filed together with the stubs, making it possible to verify collections . . . the only way there can be a failure to account for service rendered a consumer is for an error to exist on the basic billing record. . . .

"The method of handling debit and credit memos is capable of some improvement. . . . This could be (done) by providing a separate series of numbers for each clerk. . . .

"There seems to be too great a division of responsibility in the handling of inspections and the correction of the rate cards. . . .

"We have attempted a comparison (which) shows that the annual cost per service billed, covering accounting, collection and inspection ran fairly uniform for 1931 ($1.69), 1932 ($1.61), 1933 ($1.67), covering the three years of the manual billing system.

"In the year 1934, during which the (electric billing machine) system was installed and used, the cost per service billed increased six cents (to $1.73). In the year 1935 in the early part of which the punch card dystem was installed, the cost per service billed increased five cents over the preceding year (to $1.78). In the year 1936 the estimate shows a further additional cost per service billed of six cents, making a total increase over the cost under the previous (manual) system of approximately eighteen cents (or about 11 percent). . . .

"The cost of operating the present system will grow somewhat less as time goes on and the staff becomes more familiar with its operation. Then, too, the punch card machine has possibilities of further adaptation to other phases of accounting. . . . Some of these . . . have been worked out and others are in process of development. . . .

"The new duties and services performed . . . are all important, and while each one had added to the cost, the additional cost is fully justified. By far the greater part of the increased cost, in fact almost all of it should be charged to the cost of obtaining and maintaining administrative controls, which did not previously exist. Too much importance can not be attached to this factor. The lack of proper controls leads to errors in billing and collection

and creates a condition in the office which contributes to carelessness, arbitrary treatment of consumers and, in fact, actual dishonesty. Whatever the cost may be to attain it, controls should be established and maintained. . . . It is our opinion . . . that it would have cost as much under either of the other two methods and probably more under the manual methods."

Reorganization is a thorny path at best. It has been aided in Denver by public recognition of its non-political aims and motives. The day will, of course, ultimately dawn for all business when reorganization will carry no more sting and have no more implication of terrorism or of dictatorial politician-type reform than does the notion of physical reconstruction today. Every water works looks forward without uneasiness to the necessary restoration of depreciated and obsolete property. Is not similar restoration of depreciated and obsolete method just as reasonable and just as important? Such was the platform of the Denver reorganization.

PRESENT TRENDS TOWARD SIMPLIFICATION OF RATE CASE PROCEDURE

By Jacob Schwartz

(Board of Public Utility Commissioners, Newark, N. J.)

Many feel that the apparent lack of interest and understanding of rates and rate making by the general public is at least in part due to the dense technological and legal haze that seems to surround rate fixing. This should not be really disconcerting to Mr. Average Citizen since the low ceiling of visibility is perhaps even more troublesome to regulatory bodies and utility companies.

Much has been written concerning efforts to simplify procedure in adjusting rates. At the risk of repeating what may be known to many of you, it may be well to review some of the recent trends in this respect in an attempt to determine whether a really new course of procedure has been evolved.

Through the years the fundamental principles set down in Smyth v. Ames, that a public utility is entitled to a fair return on the value of its property used and useful in the service of the public, has remained the settled law. The fifth and fourteenth amendments to the United States Constitution prohibit the Federal and state governments respectively from depriving any person of his property without due process of the law. In utility cases the Supreme Court has held that these constitutional provisions require determination of the rate base or value of the property in order to apply the test of confiscation.

Many state commissions have manifested an almost insatiable desire for some more definite guide or formula than that indicated in Smyth v. Ames. Anyone who has gone through a complicated rate case can appreciate the various commissions' feelings in this respect. It seems almost incomprehensible to many persons who have reasonable, orderly minds that such an unsettled condition should obtain and they feel that there must be some more definite guide to assist in accomplishing the important task of finding a rate base.

MARYLAND DECISION

The action of the Maryland Commission in the Maryland Bell case[1] is probably too well known to warrant detailed repetition here. It is sufficient to comment that to avoid a costly rate appraisal, the commission adopted unit costs found in a prior case, and brought them up to date by use of general commodity indices, modified in a measure by the commission's judgment. It further appeared that the company was agreeable to the use of the so-called short cut, but submitted that the commission should use indices identified with the specific items of property under investigation. The commission, however, adhered to the use of general commodity indices, feeling that they were less likely to be manipulated since specific price indices could be obtained only from affiliated manufacturing companies such as the Western Electric Company which in its opinion held such important control over this field of endeavor that the price quotations were in reality not competitive.

The United States Supreme Court did not in fact expressly find that the Maryland Commission's basis resulted in a rate base which would be considered confiscatory. It decided, however, that the commission's method was basically fallacious and would not countenance its use for that reason. This determination seemed a bit difficult to line up with the court's opinion in the Los Angeles case as well as in prior and subsequent cases.

In the Los Angeles case the commission's method of valuation was objected to by the company. The court stated, however, that it looked to the results and not the method and that it would not investigate or concern itself with the commission's method as long as the commission's findings were not shown to be confiscatory.

While the Maryland Commission exercised its independent judgment to an extent in adjusting the general commodity indices, the court apparently looked upon this general method as a determined effort to provide a partially mechanical process for the fixing of rate valuations which would not require consideration of other general factors with respect to value or the proper exercise of the commission's full judgment of all the factors which might affect the valuation or rate base. The court did not deny the commission the right to consider commodity indices among other facts. Such indices provide

[1] West et al. v. Chesapeake & Potomac Telephone Co. of Baltimore City, 295 U. S. 662; 55 Supreme Court 894.

valuable data with respect to general price trends. However, the court expressly objected to a rate base formula dependent on commodity price indices. As heretofore mentioned, the court might easily have avoided commenting upon the method used by the Maryland Commission and merely determined whether the rate base as found was confiscatory or not. It apparently had a very strong urge to single out this method for criticism as a guide or marker for others engaged in valuation work.

It may be well to relate the experience of another commission in semi automatic rate adjustment.

WASHINGTON, D. C. PLAN

In 1925 there went into effect in Washington, D. C., after protracted litigation, a plan for regulating the rates of the Potomac Electric Company which the District of Columbia Commission undoubtedly felt would tend to dispose permanently of this vexing problem. As a result of a consent decree, a value of the company's property was fixed as of January 1, 1925, depreciation rates were determined and it was provided that the rate base for any year following 1925 should be ascertained by adding to the rate base at the end of the preceding year the net value of additions and betterments. It further provided that should the net return upon the rate base fixed in this manner be in excess of 7½ percent, rates for the following year should be fixed so that the gross receipts of the power company be diminished by one half of such excess. It also provided that should the net return fall below 7½ percent by varying amounts over different periods of time, that the commission should promptly increase rates so as to yield a 7½ percent return. While the plan appeared rather comprehensive, it did not completely solve the problem. Rates were reduced every year from 1925 to 1931, but due to unforseen increase in the use of electric appliances and service generally, the volume of business was such that the company's average return upon the rate base for the years referred to substantially exceeded the rate fixed in the consent decree.

In view of this situation, the commission sought to obtain amicably a modification of the consent decree, to bring about a change in the sliding scale which would lower the rate of return. But the company apparently did not see eye to eye with the commission in this matter. Considerable litigation ensued which was terminated in 1933 by a further settlement between the company and the commission which

recognized the right of the commission to modify the terms of the sliding scale arrangement. It was further recognized that the company had the right to appeal, upon the ground of unreasonableness, from any order of the commission making changes in the sliding scale, as well as to apply to the commission to make any changes in the existing scale.

It would appear that the commission found that it is neither feasible nor desirable to reduce rate making to what amounts to a process of making substitutions in an abstract mathematical formula which can not be modified.

Concerning this matter Mason M. Patrick, a District of Columbia Commissioner expressed himself as follows in an article in Public Utilities Fortnightly, dated April 27, 1933:

> "If this commission should enter into a similar arrangement in the future, it would incorporate therein a provision for the possibility of redetermination of the value of the property, or for a revision of the terms of the sliding scale, or both, at the end of fixed periods of time, say every five years, and possibly a provision for intermediary adjustments in case extraordinary conditions should arise."

MINNESOTA PROPOSALS

Although much time and effort have been applied to the formulation of rate bases, relatively few of principles evolved have been accepted as fundamental. It is interesting to note some provisions in the draft of a proposed bill concerning regulation in Minnesota. Mr. Charles A. Russell, who proposed the bill referred to, remarked that Minnesota offered in many ways an ideal laboratory for regulatory experimentation because of the rather limited existing jurisdiction of the state commission.

The proposed law provides among other things for a fixed rate base with a flexible return. It is proposed that all utility properties be valued as of July 1, 1935 on the basis of (original cost, cost of reproduction, and cost of reproduction less depreciation) which valuations corrected for subsequent additions are to be used by the state commission in rate investigations. After the completion of tentative valuations, notice is to be given the utilities to permit them to submit at hearings any objections to the tentative valuations.

A question which arose to perplex the drafters of the proposed bill was the treatment of the fluctuations in the value of the dollar which would either elevate or depress property values as compared with the fixed valuation date (July 1, 1935).

One of the suggestions was to use commodity indices whereby adjustments of the basic figures to any changed conditions could be made almost automatically. They considered that this method involved too many complications and in its stead planned to stand by the rigid rate base (July 1, 1935 adjusted) regardless of changed economic trends, but expressly placed the necessary element of flexible adjustment in the rate of returns to be allowed during varying economic conditions.

In an article in Public Utilities Fortnightly (April 11, 1935 issue) Mr. Russell, the author of the proposed bill submitted the following statement on behalf of the method proposed in the bill:

"This method of caring for changing economic conditions was preferred to any departure from the rigid rate base for a number of reasons. For example, there is the possibility of abrupt monetary inflation that might increase utility expenses so rapidly as to wreck the service if the commission had to wait for evidence of commodity trends before granting relief. Conversely, abrupt monetary deflation might create an emergency demanding immediate relief of the rate payer from rates suddenly become unreasonably high. Under the proposed law, the commission can take prompt and intelligent action in either event."

From time to time there have been suggestions for changing regulatory methods to encourage the use of more aggressive business methods in the industry. Many of these suggestions apparently look toward a program of rate determination without direct consideration of the net profit to be derived.

It is submitted that regulation of rates in this manner would in reality give greater consideration to progressive management, and would bring with it lower costs and increased use of service. It is conceded that such a plan for regulation of rates is fraught with many difficulties. It is apparently of prime importance under a system of direct rate regulation to have available sufficient accurate historical data which would indicate business trends under different rates and a rather thorough analysis of the factors which may change normal business trends. Exceptional salesmanship would also be required to open to the industry through education and proper rates heretofore undeveloped markets.

This plan of rate making would undoubtedly show to best advantage in the electric, gas and telephone field, for the sale of these services seems to respond to the stimulus of reduced rates. It is doubtful, however, whether it would be of material advantage in cases

where the market for the service or commodity is rather static, such as in the case of sales of water for ordinary purposes. It should also be noted that a normally elastic market may become restricted because of economic conditions which reduce purchasing power, and a sufficient volume of new business might not under these circumstances follow a rate reduction.

Under a plan of direct rate regulation, it is expected that the utilities will initiate rate changes and that they will submit complete data to the regulatory commissions upon which their course of action is based. Even though commissions possess adequate business judgment and vision to permit acceptance of rate programs of this nature, abrupt abandonment of methods now in use for determining gross revenue for one which perhaps is not so well understood might result in strong popular or political opposition. It should be again noted that such plans are at this time mainly of academic interest, since the determination of the rate base is still pursuant to decisions of our courts, an important and indispensable part of rate fixing.

OHIO AND ARKANSAS RULES

It, perhaps, should be interesting to review some portions of the new rules and regulations adopted in Ohio and Arkansas for conduct of rate cases. The commissions undoubtedly were pressed for time by a large number of pending rate matters and desired to effect a procedure which would reduce considerably the time consumed in presenting technical evidence and examination of witnesses.

Pursuant to the adopted rules, the testimony of expert witnesses must be reduced to writing and copies submitted to the commission and adverse parties at least ten days before the witness is to testify. When called to testify, the witness' statement which must also include his qualifications is considered a part of the record as his direct examination. When the testimony relates to more than one subject, each is to be separately identified for proper reference. Arrangements are provided to attach the record of the cross-examination of the witness to the exhibit or statement containing the direct examination. Provision is also made to replace oral cross-examination with written interrogatories addressed to the witness, answers to which are required in writing and considered part of the record in the case. These rules, while they do not represent an entirely new idea are undoubtedly a step in the proper direction for needed simplifica-

tion and shortening of rate case procedure, and do not deprive either party of any legal or constitutional rights.

We must be careful to avoid confusing simplifications such as the above which tend to shorten legal procedure and cut red tape to a minimum with so called short cuts which deny interested parties statutory or constitutional rights.

In passing it may also be well to observe that rate experts and economists, whose methods of determining rate bases are not consistent with the determinations and findings of the United States Supreme Court, are not for all practical purposes offering any real assistance in the solution of a rate case.

PRINCIPLES OF RATE NEGOTIATION

Under ordinary circumstances, the rapidity with which litigation is brought to a conclusion depends in a large measure upon the litigants. If there is no particular "animus" between the parties, and if they are disposed to procure a fair determination of their honest differences of opinion, based upon the facts and nothing more, then you have a very favorable situation for a fair solution of the controversy. Where you have extreme partisanship; an obsession to obtain the whole hog; where not the outcome of the case but the litigation itself appears all important, then the administrative or judicial authority hearing the particular case will be confronted with a voluminous record of conflicting and exaggerated claims which may necessitate spending many months to separate the wheat from the chaff in order to arrive at a determination.

Rate regulation is by its very nature a complex economic problem. Many attempts to devise some extremely simple formula for its solution have proved unworkable and disappointing. Numerous necessary corrections to adjust for variable quantities (not readily controllable) baffle attempts to reduce the results of many investigations and experiments to a definite formula which can automatically and at the same time properly and legally be substituted for intelligent human judgment.

The utility business cannot as a whole be considered an infant industry today. If an accurate financial history of the industry was available from its inception, the trend of regulation and court decisions might have been entirely different. Careful and honest adherence to uniform, standardized accounting practices, provides a real method of reflecting the experience and historical development of the

industry. Such factual data, when available, will command proper respect and attention and what may even be more important, will tend to minimize a rather popular feeling that there is something iniquitous or tricky about utility bookkeeping. General distrust of your opponent's ethics and methods, tends to lessen opportunities for mutually satisfactory compromises of differences, throws the door wide open for the initiation of long drawn out investigations, and sets the stage for a knock down and drag out fight to a finish from which, as a rule, both parties to the controversy retire to their respective corners after the final bell, rather sad spectacles to behold. The referee's decision is alternately booed and cheered, and the battlers surrounded by their handlers and trainers, are frequently persuaded that a return match is really necessary to settle the controversy. Furthermore, the fighters' purses after deducting all training and overhead expenses are probably lean.

Through the years no panacea or cure all has been developed for settling rate conflicts. The most promising signs on the horizon are continued efforts to promote better understanding between the utilities and their customers; this is the basic foundation for conference and compromise. Reasonable commission rules are necessary to speed up procedure, to cut red tape to the bone, to require both parties to confer before formal hearings, to draw up stipulations of agreed facts and to submit only clearly defined points of difference for determination by the commission. And in conclusion, it must be made very clear that while trading in a used car or buying a piece of real estate, the parties may with personal advantage drive as hard a bargain as possible, this same situation does not obtain when the transaction is, as is the supplying of utility service, of a continuing nature. The service must be adequate and the compensation must be fair, or it will not continue very long.

APPLICATION OF TABULATING EQUIPMENT IN ACCOUNTING PROCEDURE

By Frank Twohy

(Bureau of Water Works and Supply, Department of Water and Power, Los Angeles, Calif.)

The science of accounting is so closely related to and dependent upon mathematics that all changes or refinements in mathematical procedure or equipment are given sincere and earnest consideration by the accounting profession. Unfortunately, the sight of cards perforated with holes passing through machines and sorting themselves into numeric sequence; then proceeding through other machines with the result that printed reports are obtained automatically; has always surrounded the punched card method of accounting with an aura of magic and mystery, which in good tabulating procedure always disappears upon investigation leaving a very simple progressive operating method.

Contrary to general belief the use of punched cards and tabulating and sorting machines is not an extremely recent development. In fact, this medium for volume mathematical problems has been in use for over 40 years. During the latter part of the 19th Century the preparation of census reports was becoming such a tremendous task that those in charge were painfully aware of the fact that even by use of the best known methods and equipment then available, the reports would be so long delayed in preparation as to make their contents merely historical. Bowing to the old adage that "Necessity is the mother of invention," Doctor Herman Hollerith conceived of perforating holes in cards instead of transcribing by hand; then, by use of electro magnets actuated by electric contacts made by the holes in the cards, the tremendous amount of sorting, classifying, and adding could be done by automatic machinery. The punched card system was adopted by the Census Bureau in 1890 after a very satisfactory test on vital statistics. It is interesting to note that this test established that holes could be perforated in cards as a means of original transcription in approximately three-fourths of the time needed for any other type of transcription; and that once prepared

the cards could produce classified figures and totals eight times faster than any other method of compilation.

It is only natural that during the early part of the 20th century many large organizations used the punched card and tabulating equipment method rather extensively for analytical and statistical purposes, with here and there a direct application to accounting procedure where volume was sufficient. The entrance of the United States into the World War called for the necessity of speed in accounting by virtue of the necessity for speed of manufacture and distribution of goods with the result that tabulating equipment became a more important factor in the accounting world. However, it must be borne in mind that the only purpose the tabulating equipment served was the performance of the hard manual labor of handling a tremendous volume, as all results of tabulation had to be read out of accumulating counters and subsequently transcribed in presentable report form. Subsequent to the close of the World War, machines were designed which in addition to compiling the information would print the results. Therefore, it is logical to assume that tabulating equipment as an accounting aid, in so far as general usage is concerned, reached a position warranting investigation in the early 20's. The speed, flexibility, and accuracy of this equipment have progressively and aggressively improved since that time with another important point in its career occurring in the early 30's. This last step on the part of tabulating equipment has to do with the inauguration of alphabetical equipment.

In manufacturing alphabetical equipment it became apparent that certain electrical contrivances, which were necessary in order to have alphabetical equipment, offered a great opportunity for use in numeric applications. These new electrical contrivances offered the possibility of tabulating simultaneously different types of cards with the printing machine selecting the type of card to be printed under the horizontal columnar headings of the report. This latter feature appears inconspicuous at first view, but investigation discloses that it is second only to the advent of the printing machine itself in the matter of value to an accounting procedure.

APPLICATIONS IN LOS ANGELES

The application of tabulating equipment to utility bookkeeping and billing problems as well as payroll and labor distribution and general accounting problems has more or less naturally followed the

availability of equipment as designed and marketed by manufacturers. The first application made by the Department of Water and Power of the City of Los Angeles was to consumers' billing and bookkeeping operations. There has been no change in the basic procedure since its inception other than that the Department now bills both electric and water services together with any balances forward by the use of but a single tabulating card for the entire account; whereas, originally an individual tabulating card was necessary for each service and for each balance item.

Bookkeeping and billing

The fundamental reason for the application of tabulating machines to billing and bookkeeping procedure is the use that can be made of sorting and gang punching equipment. It is unnecessary to compute each bill from the meter book at time of original transcription to the addressographed tabulating card, because the sorting machine accumulates all like units of consumption in one group so that amounts can be gang punched to the entire group in one operation. The tabulating machine is utilized in furnishing a statistical report of great value in determining unit of consumption use by consumers, which at the same time offers an audited report proving conclusively that all consumption is billed in accordance with the rate schedule. Upon completion of the checking of this proof sheet the tabulating cards are sorted to account number and balance forward information incorporated on them. Account number sequence is street and address order which is also the sequence in which the bill forms are addressographed. The bill is completed by printing on it from the tabulating card the meter readings, consumption, amounts, etc., with the tabulating machine automatically furnishing a total whenever more than one item appears on it. It is practically impossible to gain the benefits of the group extension plan without tabulating equipment. It would be possible merely to abstract meter readings and consumptions from the meter book with other types of equipment. However, unless this information is punched on a tabulating card the job of hand sorting to like units is too tremendous to attempt. However, when it is abstracted from the meter book to a tabulating card, the machines very speedily and accurately can sort the cards to the desired consumption sequence. With respect to this, it is possible to extend the amounts on the tabulating card before making a final sort to classification, when classification does not affect the

rate to be applied. Furthermore, an additional sort can be made by district before making the combination analytical and proof tabulation wherein district reports are required.

After the bills have been completed and mailed to the consumers, the tabulating cards are filed in the Bookkeeping Section. When cash payments are received, the cards are withdrawn from file and are punched with numbers indicating the date and place of payment, tabulated for daily cash receipts distribution and placed in the closed file. The withdrawal of cards is a very speedy and simple operation, because it is necessary only to compare the account number as shown on the cashier's stub to the account number of the tabulating card to insure the accuracy of posting. As far as balancing the accounts is concerned, it is theoretically impossible to be out of balance because the same tabulating card which made the bill which the consumer received is withdrawn at the time the bill is paid. The use of punched cards as ledger records naturally results in only the current month's information being in the open file. In order to furnish chronological records or statements of accounts to consumers whether requested by phone or in person, the ledger cards for the two previous months are maintained in file immediately below the open file. History has shown that this is sufficient record to maintain in answering most inquiries. The balance of a two-year record is maintained in file in the same building and is readily obtainable when necessary. However, it is very seldom that conditions arise which call for reference beyond the 90-day period. Summed up, the use of punched cards and tabulating equipment results in a billing method of guaranteed accuracy, a speed which enables bills to be mailed on the third day following meter reading, and a ledger record which is most easily maintained in balance. From a collection standpoint it is necessary only to refer to the few open items in the ledger when instituting collection proceedings whether they be courtesy notices mailed or duplicate bills rendered.

Payrolls

It is in connection with payroll and labor distribution problems that the most recent tabulating machine developments are of greatest use. The Department prepares its payroll and pay checks on the tabulating machine and prepares the distribution and cost reports without the necessity of singly extending daily time tickets. A master tabulating card is prepared for each employee and maintained

in file for the duration of employment. This card has the name and classification punched on it alphabetically and other such pertinent information as rate, date of employment, age, sex, division, etc. A second master card is maintained for controlling hourly rates to be applied. This single rate card suffices to bring about desired results of paying on a calendar basis and distributing on a work day basis. This card is punched with the rate per day or month, the pay rate per hour for a 31 day month, a 30 day month, a 29 day month, and a 28 day month, and the distribution rate per hour which is based upon an annual working hour basis. The annual working hours are determined by the number of actual working days in the current fiscal year with a prescribed allowance for sickness and inclement weather. Working on a fiscal year basis, allowance is made that for all new employees the working days forecast provide that a vacation will not be taken. Individual time cards for each employee are made daily. These time cards show employee number, the hours worked, and the distribution of those hours. In this connection there is no rating of the time cards. Tabulating cards are punched daily from the time cards showing the hours and the distribution therefor.

At the close of a payroll period these detail tabulating cards are incorporated with the master rate per hour card and certain other cards which represent various payroll deductions and the entire file sorted to employee number sequence. A tabulation is made listing in detail each card, which results in showing the days and hours worked and the accounts which are charged for each hour of each employee's time. The tabulating machine by using the new selective relays, which were discovered when alphabetical equipment was first under laboratory consideration, selects from the rate card the rate per hour, totals by straight tabulation the total hours, totals by straight tabulation the amount of deductions, and automatically punches a summary card with this information. This boils the entire group of cards down to one tabulating card per employee per pay period. This single card is then processed through a multiplying punch, which by multiplying the hours time the rate per hour, arrives at the amount earned. The amount of deductions is subtracted from this amount, and the amount due is punched—all of this by mechanical process. This single card per employee now being complete as to time worked and the compensation therefor, is matched with the master name card, and, automatically the name

and classification is copied from the master card and punched to this summary card. The preparation of the payroll report is, therefore, a mere listing of these summary cards.

As a matter of cold statistics, a 33-name sheet of payroll, showing in detail the classification, the name, the rate, the time worked, the amount earned, the amount of deductions, and the amount due for each of the 33 employees is printed, together with a sheet total, in 26 seconds. Upon completion of the last sheet of payroll a payroll total is printed automatically and the payroll report is complete.

The same tabulating cards which made the payroll sheets are then re-processed through the alphabetical printer and pay checks in continuous manifold form are printed with the name of the employee and the amount due. This check production is at the rate of 80 per minute. The pay checks still in continuous form are processed through a special signing machine which is set up for the amounts as shown by the payroll and performs these operations: It serially numbers the checks, dates them, prints the amount of the check in letters as a protectograph feature, signs the checks by a signature plate, at the same time printing pay check numbers on the payroll sheets; and prepares an adding machine tape for the total amount of checks signed, which serves as an auditing feature in establishing the fact that pay checks made agree with the amount of the payroll itself. The production of this signing machine is approximately 450 checks per hour. Attached to this signing machine is a special cutter, which, as the checks are ejected from the signer, cuts them and drops them in a receptacle in numerical sequence.

It must be remembered that all payroll reports are prepared by the use of this summary card which was obtained automatically and which was mechanically extended in arriving at the money value to the employee. Therefore, while this payroll work is in progress the detail file of cards, which were the basis of the preparation of the summary card, are being processed through a gang punching machine which picks up the distribution rate per hour for each employee and punches it to the detail cards. By this operation we arrive at the condition of having the individual rate on each tabulating card, which was punched from the original time cards, without having had to show the rate on the time card itself. The detail tabulating cards are accumulated by sorting machine to rate and account number and a tabulation prepared which totals the hours of each rate chargeable to each account at which time a summary card is punched with this

information. This single summary card is processed through the multiplying punch for extension, and in making distribution reports it is necessary to tabulate only these summary cards. It is possible under a system like this to boil a file of approximately fifty thousand cards down to approximately five thousand cards, depending, of course, upon the number of rates in effect and the number of accounts or other distribution elements.

The use of tabulating equipment has been of great value in the elimination of the necessity for weighting direct labor charges with an added percentage to take care of the payment of monthly salaried employees on Saturdays, Sundays, etc., as well as both monthly and daily salaried employees for vacations and granted holidays. By having a master card which not only has the pay rate per hour but the distribution rate per hour as well, it is possible to pay the employee on a calendar basis and distribute on a work day basis with as much ease as if distribution were made on the pay rate basis. From an auditing standpoint, all rates have been coded numerically, and during the payroll procedure a tabulation is made showing the total hours paid for each rate, and when the distribution tabulations are being prepared a report is made showing the total hours distributed for each rate and the total undistributed hours for each rate, which allows a perfect check that nothing in the way of accuracy is being lost by not distributing dollar for dollar with the payroll.

Intangible benefits

Many investigations of the adaptability of tabulating equipment are very thorough throughout the actual application of the cards and machines to current operations, with very little attention, if any, paid to some of the intangible benefits. One of the most important features of punched cards and tabulating equipment is the possibility to reconstruct records. In other words, with all postings represented by a punched card, it is possible at any time to reconstruct reports because the tabulating card will always record the same information when tabulated. As to the length of life of the card itself, for all practical purposes it is safe to say that it is impossible to wear it out. From a general accounting standpoint this possibility of reproduction of record is of immeasurable value to concerns employing outside auditors for purposes of annual general audit. The opportunity of referencing every posting made to any account to the original document for an entire year and by use of the sorting machine to have

these documentary reference numbers appear on the report in filing sequence should result in a great saving of time expended by outside auditors in auditing accounts.

In the final analysis it appears that the use of tabulating equipment from an accounting standpoint is about to emerge from the kindergarten stage. The accuracy of the machine has been developed to a point comparable with that of automobiles. That is, we can naturally expect some refinements, but they will be in the nature of luxuries not necessities. The final step on the part of tabulating equipment is the use of automatic carriages which permits having forms printed on continuous manifold paper which completely eliminates the necessity for operators individually inserting sheets for reports. This particular feature has within the past year been so developed and perfected as to make the preparation of all long reports a matter of feeding a single sheet of paper at the start of a report only, the automatic carriage, without manual aid, ejecting each sheet when the bottom line is printed and commencing at the top of the following sheet.

OVERCOMING PUBLIC OPPOSITION TO WATER METERS

By H. L. Meites

(Superintendent of Water, Chicago, Ill.)

Nowhere in the country is the question of water meters so acute, so important and so urgent as in Chicago. In fact, for a time it was made a campaign issue in the election for Mayor and a very able, conscientious Mayor was defeated because of his staunch belief in the merit of meterization; because he was honestly convinced that the only fair and adequate method of selling water in Chicago is through meters. It was his opinion that when Chicago has become completely meterized it will be possible to filter its water supply which is, at present, not of the very best.

Public health authorities and the public generally are constantly demanding a higher standard of purity for domestic water supplies, and it is not to be expected that the people of Chicago will long be content with a supply which is inferior to that of other great cities of the world. It seems safe to predict, therefore, that in the not far distant future they will demand better water than is now being served and that the problem of a really pure, clean, and wholesome water supply with which the City has been struggling since its earliest days will be finally solved through filtration.

For Chicago, Lake Michigan furnishes an inexhaustible quantity of water of a high degree of original purity. That the City has always had trouble with the quality of its water supply has been due principally to the vast amount of human and industrial wastes which Chicago itself and the neighboring cities and towns have discharged into the lake. As related to health, therefore, the problem has been largely to avoid and to prevent this pollution. The increasing quantities of filth to be disposed of, as both Chicago and the neighboring territory along the shores of the lake have grown in population and in industrial importance, and the more exacting requirements demanded in recent years by higher standards of purity have added greatly to the difficulties of the problem. Within the past few years efforts to avoid and to prevent pollution have been supplemented by treating the water with chlorine as a means of further purification.

Filtration can only come through meterization. There is no other alternative. And the sooner Chicago becomes completely meterized the sooner the citizens of Chicago will have clear, filtered, wholesome and palatable water. Not before. Meters must come first.

The situation is aggravated because a considerable number of our City Fathers, the aldermen, are opposed to meterization, some because of unfamiliarity with the facts, others because they fear that their constituents will have higher water bills and come to them with their complaints. All of this opposition has been formidable and adamant.

The City Council of Chicago, the governing body of our City administration, decided in 1935 on a meterization program on an extensive scale, but before that was put into operation it was deemed advisable to have a public hearing to determine the feeling of property owners toward the plan. Surprising as it may seem there was more opposition to meterization by members of the committee than by those present representing property owners. Our constant efforts in educating and enlightening the public with the fact that the meter is the best friend of the property owner, was most forcibly brought to the surface. We have succeeded in reducing opposition to meters to a minimum.

We have argued the point, at these public hearings, that experience and careful study have demonstrated beyond a doubt that where meters have been introduced they neither restrict the use of water nor increase water bills. They produce results not by restricting usage but by preventing waste and leakage. We pointed out that preventing waste and leakage means reducing so far as is practical the loss of water through leakage and other means, and it does not mean curtailing or restricting any person in his accustomed use of water.

It was further pointed out that metering is essential for Chicago because it is the most effective means of insuring an abundant supply of water under sufficient pressure to enable our consumers to obtain promptly and at all times the water which they require and are entitled to for their legitimate usage. Such a condition has never existed in Chicago.

Notwithstanding its obvious advantages, there is generally a strong prejudice against metering wherever it has not been adopted. It is significant, however, that cities in which meters have been installed have not gone back to former methods, the meters having proved satisfactory both to the municipality and to the consumers.

Landlords are generally among the opponents of meters, because they fear that their bills will be increased by the wasteful and careless practices of their tenants. But experience also has shown that this fear is not well founded; that the number of tenants who wilfully waste water is insignificant; and that, where the landlord complies with the ordinances of the City requiring plumbing to be kept in repair, he has no reason for apprehending that the installation of a meter will penalize him.

Believe it or not landlords present at the public hearing quoted certain phrases and arguments we had used, from time to time, in our publicity material in favor of universal meterization. The average property owner does not oppose meters especially when he becomes familiar with the facts and existing conditions; when he gets to know that waste of water wastes the taxpayers' money in that large quantities of coal must be used at our pumping stations which could otherwise be saved. A little light on the subject brought most gratifying results.

Like every other important innovation it takes courage to make the first move, the first step, and the rest comes easy. I have had that experience demonstrated most forcibly when I decided to change the old, dilapidated and archaic billing and accounting system in vogue in the Bureau of Water in Chicago and substitute for it a modern, up-to-date, mechanical billing and accounting system which has proven not only most economical but most efficient.

Yes, I had plenty of opposition at first, simply because the old system was claimed to be "good enough, why make a change." But once the change was made even the scoffers realized their error and are not constant advocates and boosters of the new system.

The same holds good with meterization. We find that those who opposed it at first did so because of their indifference to new moves, to improvements, to innovations—who believed in letting things alone. But when convinced that civilization cannot remain static, but must be always on the march forward—those opposing any change were in the first rank shouting and demanding it.

I carried on a constant, persistent and, I believe, convincing campaign through various means—using printer's ink to the fullest extent. We printed on the back of our water bills, which I showed on a previous occasion, messages urging water users not to waste water, and to keep plumbing in good repair—with remarkable results.

We have prepared a booklet, soon to appear, telling graphically

and simply the story of the important part a meter plays. These illustrations tell how most every commodity is purchased through a definite measure, no guess work. Why not do the same with water which is, after all, the most important commodity of all?

I have appeared before various cultural and social groups, women's clubs, parent and teacher organizations, and explained the purpose and value of a meter; how a meter in a house will check waste; that bills for water registered by a meter are not higher than flat rates but, on the contrary, often much less.

I utilized the terrible drought in the West last year to point out the devastation and ruin to man and beast brought about by lack of water. Also during the extremely cold weather we had in Chicago last winter when countless thousands of water pipes froze, depriving a large number of men, women and children of the life-giving fluid—water—and the hardships it brought in its wake.

I pointed out during these talks that in normal times water is just as important as during abnormal conditions and should not be wasted uselessly. I spoke of the majesty and the charm of water. I even often philosophized about the sheer beauty an expanse of water holds for us; how the most restless and most worldly of us can sit for hours content in gazing at a fluid horizon, fairly hypnotized before its endlessness and vastness—the restful rhythmic slapping of water, the seething thunder of the surf, the glitter of the sun and the foaming and boisterous head-high breakers our own Lake Michigan often displays.

All these talks led to but one conclusion—the elimination of useless waste of water which could only be brought about by the installation of meters in every home. Our citizens are gradually becoming water—yes, and meter—conscious, and are coming to the Bureau of Water in increasing numbers, asking for the installation of meters.

All of which brings out the incontestable fact that public opposition to meters is due largely to unfamiliarity with the facts and once the people get to know that a meter does not increase the cost or curtail the supply of water, that you pay only for what you actually use and not for what others waste—all opposition to meters ceases.

I have tried it in Chicago and speak from personal experience. I would therefore suggest that before a city goes into the installation of meters on an extensive scale, it should make good use of printers' ink; use well directed publicity; tell your story simply, graphically and honestly, and all opposition will vanish into thin air.

PUBLIC RELATIONS

By James E. McCaffrey

(Representative for Southern California; California Railroad Commission, Los Angeles, Calif.)

During the past decade much progress has been made in improving business relations between public utilities and their patrons. Because of present economic and political conditions, good "public relations" are now more important than ever. Rapid strides in the taking over of utility properties by state, municipal and other political subdivisions can be accounted for in no small degree by the lack of proper "public relations."

Farsighted and well informed managements are giving the subject much thought and intelligent direction; however, to my knowledge, there has been as yet no "John Wanamaker" on the utility horizon to demonstrate that "Businesses devoted singly and sincerely to benefiting the public as well as the owners cannot be extinguished." The non-existence of a great "public relations" pioneer in the utility field may be due largely to the lack of business competition, each utility being more or less supreme in its own territory. This lack of competition in most states has resulted, generally, because of the advocacy of and the natural tendency toward "regulated monopoly," rather than "regulated competition." I am reminded that just recently Mr. Samuel T. Bledsoe, President of The Atchison, Topeka and Santa Fe Railway Company, in reciting his general experience and convictions before the Railroad Commission, stated that "regulated monopoly" could not best subserve the general public welfare and that only under "regulated competition" could the public gain the maximum of service for the minimum of expenditure.

I also recall that some years ago Alex Dow, that capable and shrewd head of the Detroit Edison Company, in testifying before the Commission in connection with a condemnation proceeding, stated that he could see no disadvantage to municipal competition but, to the contrary, considered it a decided boon to both the utility and the public, in that under such circumstances it was possible to keep

utility employees more alert and efficient, thus resulting in better service and more courteous and careful treatment of patrons which, in turn, redounded to the utility in the form of increased good will. The matured judgment of these experienced operators, as above expressed, might be construed to mean that good "public relations" can be productive only when competition exists. This is not the case, of course, since proper "public relations" build good will and thus tend to destroy, or at least make impotent, unfair competition, potential or otherwise.

Students who have given serious thought to the subject have come to realize that the "public relations" problem in California is perhaps more difficult than in any other portion of the country. This is due to the fact that California, because of the active sales efforts of its numerous Chambers of Commerce and its naturally attractive climate (I am not a member of the Chamber of Commerce, nor am I a native of California), is a "Mecca" for all that's good, bad and indifferent; in other words, a cross-section of the entire country. The "public relations" problem is especially pronounced in Southern California, where many retired patrons have little to do but to raise issues on the "principle of the thing" and where for many, on account of life long saving and scrimping to locate here, the penny takes on more than unusual significance. Wealth is here in abundance (comparatively speaking), and consequently, with it, the chiselers and dead-beats. The warm climate also attracts much of the indigent floating population, with resultant gray hairs for credit managers and complex problems for "public relations" men. More than its share of morons, quacks, charlatans and religious fanatics, with their attendant problems, are located in Southern California.

The California situation is mentioned merely to indicate that my observations and views are made with full knowledge of the trials and tribulations of the "public relations" men. I sincerely appreciate the difficulties confronting such men and I am fully aware that utility executives are earnestly endeavoring to improve "public relations." Nevertheless, after many years of contact with the public and knowledge of the treatment generally accorded it by utilities, I am impelled to the conclusion that a very drastic change in organization set-up and approach to the problem is necessary if justifiable utilities, whether publicly or privately owned, are to remain even remotely free from unwarranted political and radical attack. While much progress has been made since the "public-be-damned" policy

was rampant—and especially in the last decade—I do not believe that the importance of good "public relations" has as yet been fully realized, either by the larger or smaller utilities, whether privately or publicly owned.

Because results appear to be intangible in "public relations" work, it is difficult for most managements to recognize the necessity of putting money into channels that cannot directly be seen to be productive of dividends. Careful analysis of past developments indicates, in my opinion, that little or no real thought has been given to the insurance aspect of the matter; that is, the good will that can be built up to off-set unfair opposition, contemplating displacement of all or a part of a utility. Nor does it seem that the effect of good "public relations" in developing new business is properly realized. Generally speaking, it appears to have not yet been recognized that the art of dealing with the public calls for and requires the highest order of intelligence. The executive in charge of "public relations" should have not only a thorough understanding of human nature, but also should have, I am convinced, an all around general knowledge of the utility's entire operations. To obtain this fountain of wisdom requires that proper compensation be accorded to the "public relations" executive and, likewise, to his staff.

There also appears to be a real misconception of the duties of the "public relations" department in most utilities. More often such department is headed by a lobbyist or a publicity man. It is true that a good "public relations" man might be capable of performing the duties of all three offices but, if he is to deal effectively with patrons of his utility and the public at large, he cannot be expected to have time for lobbying, publicity work or stock selling campaigns. In fairness to all, it can be candidly said that there are all too few really capable "public relations" men in the utility field today. Personnel can be trained, if mentally equipped for the work, but careful analysis of the "attributes" of capable "public relations" men indicates that the outstanding men in this field have been endowed with unusual talents, as is the case of men blessed with great talent for other lines of endeavor. There are, of course, a number of individuals gifted in the art of dealing with the public, but too often their talents are used in other work considered more important by the management.

I can best illustrate this point by pausing to recite an example of how one of the largest utilities in this state failed to understand the

requirements of good "public relations." A very efficient young lady, with an unusually attractive personality, was employed in one of the more important districts of this utility to answer complaints, etc., over the counter. On several visits to this district I noticed that this employee seemed to radiate cheer and confidence, as patrons all appeared to leave in a very friendly frame of mind. Some months later it was noticed that this girl was not at her usual place in dispensing good will. Upon inquiry, I learned that she was considered to be quite valuable and therefore had been advanced to a position paying more money but in an inner office. This misconception of the value of such employee to the utility is not unusual and serves perfectly to show the lack of understanding that prevails regarding the importance of the work in connection with "public relations."

Another misconception regarding the duties of the "public relations" department is that most managements confine the training of personnel to the commercial department. No thought is given to the necessity of putting meter readers, bill collectors, construction and operating men who, in various capacities, contact the public in some form or other, through a course designed to fit them for dealing with the public. No matter how effective is the staff of the commercial department in its contacts with the public, one untrained service or construction man can utterly destroy the good will sought by the utility. These experiences are too numerous to need mention.

There are, of course, impossible situations to deal with, which cannot be overcome by even the best of "public relations" men. One humorous instance comes to my mind, involving the speaker. While employed as a trouble shooter with one of the larger electric utilities in the state during a strike, it befell my lot to answer a "no light" complaint in an obscure part of town. The fuses, as was the case most often during those days, were located under the front porch. Only a small opening, approximately eighteen inches square, was provided in order to reach the switch. In response to my inquiry concerning the difficulty, the lady of the house insisted that the trouble was at the meter, whereupon said trouble shooter proceeded to climb through the narrow opening. Apparently there was a well designed plot on foot to put any such strike breaking trouble shooter out of commission, as bricks had been laid up alongside of this opening. This, of course, being accompanied by a lady, did not impress the trouble shooter at the time. Upon getting half way through the hole, a most vigorous, if (fortunately) not so accurate broadside and

barrage of bricks were launched by the so-called lady of the house, together with one of the finest sallies of the United States' most popular language that I had ever been privileged to hear. While I then was not in a position and frame of mind to fully appreciate this wealth of words, I subsequently realized that the Navy and the Army—not to mention stevedores and mule skinners—were only humble beginners in the art of delivering pointed remarks. Needless to state, the trouble shooter beat a hasty retreat as soon as the ammunition was exhausted. I am satisfied that no "public relations" man could have mastered such a situation.

Getting back to the subject, I wish to point out that in California numerous complaints made to the Commission have been due to the fact that the complaint, when originally made to the utility, was not handled by an employee understanding the meaning of "public relations." One of the real difficulties, in this connection, is that rules and regulations of utilities are not thoroughly understood by the large majority of employees enforcing them. To most of them it is merely "the rule" and that, unfortunately, is their entire answer to the customer.

Too often I have found that employees take utility complaints as personal criticisms and that many are all too ready with answers before the complaint is properly understood. It is safe to say, in this connection, that the bright young man, who is desirous of impressing the consumer with his knowledge, and the middle aged man, set in his opinions, are not those who should be permitted to contact the public.

I, like many would-be reformers, have a panacea for all evils. In the main, it is most radical compared to "public relations" policies now generally in effect. This "cure all," which undoubtedly will be heartily disagreed with by most managements but which, nevertheless, may justify its existence by provoking some thought, follows:

1. Select the best informed and most intelligent officer of the utility to head the "public relations" department.
2. Give such executive the dignity and authority of position to initiate and enforce all policies affecting business relations in any way involving the general public.
3. Compensate such officer and his staff on the highest salary plateau.
4. Permit employees to graduate to the "public relations" department only after having demonstrated a well-grounded knowledge of the utility's entire operations, and then select for training only those peculiarly and particularly fitted for the work.

5. Dignify so-called "counter clerks" dealing with the public with titles and compensation indicative of their work for and in the "public relations" department.

6. Require that all employees, regardless of department, who in any way contact the public, be trained by the "public relations" department and, further, be responsible to such department for such contacts.

7. Keep in mind at all times that there are many capable attorneys, engineers and accountants available but that good "public relations" men are few and far between, and mostly are born.

It of course is recognized by all that the small utility operator, who has to perform every duty from that of the President down to the office boy, will not be able to devote the proper amount of time to "public relations." All utilities, especially in these days, are judged by the company they keep. It is most important, therefore, that the small operators be given as much assistance as possible. Discussion of the subject in conventions such as these will do a great deal toward improving the general situation. Much good by regulatory bodies can be done by bringing to the attention of managements examples of discourteous treatment and lack of knowledge on the part of employees, in explaining rules and regulations and policies of the utilities.

After all that can be said and done on the subject, it is fundamental that good "public relations" be based upon adequate service under reasonable rates. It is my viewpoint, however, that considering rates, service and "public relations" as three distinct factors, the most important is that of "public relations"; service next and rates last. While this is only a matter of opinion, it must be recognized that, even though service is adequate and rates are reasonable, the good will of a utility in its community is mostly measured by the treatment its patrons receive.

I cannot help but feel that the policies enunciated and put into practice by John Wanamaker are even more important today than during the period his cardinal principles of doing business were established and that they are applicable to utilities as well as to business in general. A few of these homilies which may be referred to with profit, follow:

"The store takes the side of the customer."

"We can keep a business only by deserving it. If we organize and go about it systematically, we can get the customers. But the real hard thing is—to keep the customers after we get them."

"Place yourself in the customer's place and give such service as you would like to have given you were you buying instead of selling."

"Do not be content to simply wait upon the people, but unobtrusively fit yourself to the moods, requirements and conditions of the customer."

"If customers come back with anything for return, be, if possible, more agreeable than if they had come to make other purchases."

"Do not allow yourself to talk down other stores."

Wanamaker's messages to his employees, given at various times, quaint though they may appear, likewise are equally fitting in the public utility field today. Following are some of these which may be considered applicable to utility employees:

"Keep sweet."

"Keep listening to your customer rather than talking yourself."

"Take care to be accurate."

"Take no offence under any circumstances."

"Take firm hold of anything that displeases a customer and set it right before leaving it."

I have implied that all is not well in the utility field, in that the subject of "public relations" as yet has not been given its full place and share in the sun. This may be considered by some as an indictment against public utilities in general. It is not so intended. Much that has been said here similarly applies to other lines of business, where there is a more direct relationship between good "public relations" and business success or failure. In the utility field, where monopolies virtually exist, even though regulated, the danger of failure is not so apparent but it is there nevertheless and if I, in this rambling fashion, have stimulated further thought on the importance that good "public relations" play in the success or failure of public utilities, I shall feel that something has been accomplished.

UNEMPLOYMENT COMPENSATION: SOME PERTINENT CONSIDERATIONS

By Samuel Leask, Jr.

(*Member, California Unemployment Reserves Commission*)

The Social Security Act has three major branches . . . public assistance, old-age benefits and unemployment compensation. In our discussion today we shall confine ourselves to the unemployment compensation provisions; and inasmuch as you are here representing many states, it would appear that the most constructive approach is one whereby we may analyze the possibilities open for the enactment of practical legislation in those commonwealths having no laws at the present time; and the improvement, by amendment, of such state statutes as are already in effect. Much of what I have to say may be elementary to many of you but it seems important that all of us should have a sound background; so I shall treat in detail the basic principles upon which American unemployment compensation legislation is founded.

It would seem that if we were ever to have a general application of unemployment compensation in this country a Federal enabling act, providing means whereby the central government might stipulate a degree of uniformity between the states, must have become a reality. The presence of forty-eight states, each supposedly sovereign in labor and industrial matters, made it difficult for the proponents of this legislation to get action even when there was a favorable popular local sentiment. For industrial competition between many of the States is severe, and if any one state imposed a tax which raised costs, it thereby placed the employers within its borders at a disadvantage as compared to other firms in states which did not have comparable laws. When the Federal administration decided to sponsor unemployment compensation legislation it became necessary, therefore, to create some structure which would bring all the states into the system and yet preserve the rights and powers reserved to the individual states by the Constitution.

It was apparent that any one of three lines of approach might be followed:

First; an outright national plan, which would disregard state lines and provide benefits paid direct by the Federal Government. The proponents of this scheme pointed out that it would enable uniform rules and uniform amounts of benefit to be established throughout the country and claimed that improved personnel standards could be maintained. Also that administrative records could be relatively centralized and a standardization of forms effected. Further, that an outright national system would more fully protect the interests of transient workers, many of whom move from state to state and in so doing, apparently lose their eligibility to benefits under the residence requirements of the various state laws.

As the investigation progressed, however, it became evident that there were many reasons why an out and out national plan should not be instituted, unless absolutely necessary. The "states rights" sentiment is still strong in the country as a whole and a general movement toward centralized control would undoubtedly have aroused powerful local prides and jealousies which would have endangered the program. Moreover, the Constitution gives no direct authority to the national government to legislate in such matters. The advocates of the Wisconsin plan were also anxious to see a Federal-State, rather than a national system, fearing that the influences in favor of a national plan would look with disfavor upon the company reserve principle upon which the Wisconsin law is based.

Second; a system whereby the Federal Government would collect certain taxes and then turn over to those states, passing satisfactory unemployment compensation laws, "block" grants of money sufficient to provide benefit payments. It was argued by those favoring this proposal that the collection of contributions would be centralized, but the local administration would be decentralized. Furthermore, the "block" grant plan has a broad background of precedence in our constitutional history. Federal land grants to the states to promote higher education and, later, appropriations of cash to further research are well known and their constitutionality has never been seriously questioned.

Third; a tax off-set system; which proposed that the Federal Government levy a payroll tax upon employers, but provided that where a state had passed a mandatory unemployment compensation law

which met certain minimum standards, then the taxes paid by employers to a state fund would be credited, either in whole or in part, as an off-set against the Federal tax. In this way, any state which passed an unemployment compensation law would not be adding to the financial burden of its employers but would merely be transferring for the relief of local unemployment, and therefore, presumably for the reduction of local taxes, sums which would otherwise go to Washington and be spent for undetermined purposes. On the other hand, states which did not pass such laws would not be able to obtain any unfair competitive advantage for the firms within their borders; since these would still be compelled to make their payments to the Federal Government. The constitutional precedent for this plan came from the Federal Inheritance Tax Act, passed during the Coolidge administration, which provided that 80 percent of the sums collected on account of estate taxes would be returned to those states having inheritance tax laws. Florida attacked this legislation on the grounds that it was both un-American and unconstitutional, but when the issue was presented before the United States Supreme Court in the case of Florida vs. Mellon, that body unanimously declared the Federal Act to be valid.

Supporters of the "block" grant system opposed the "off-set" plan because of the fear that under it the Federal Government would not be able to constitutionally lay down sufficiently stringent standards to which the state laws would be compelled to conform. It was thought that if many standards were imposed upon the states, the Act would be regarded by the courts as being primarily regulatory and hence, under the precedent furnished by the second child labor case, would be declared unconstitutional.

It was also pointed out that the "off-set" feature carried with it the almost inevitable conclusion that each state would tend to make equal percentage levies upon the payrolls of employers; for any additional tax would expose the employers of that state to that competitive disadvantage which it was the purpose of the plan to remove. And inasmuch as statistics show that there is a very definite difference between the average volume of unemployment in the several states, a gross inequality in benefits to insured workers would inevitably result.

To make a long story a little shorter, the tax "off-set" plan, for the payment of benefits to eligible workers, was finally approved by the Administration and sent to Congress, as a part of the Social

Security Act, where it was passed by both Houses and approved on August 14, 1935.

One of the major arguments that influenced the decision of the authors in favor of the "off-set" plan, as opposed to the "block" grant proposal, was that if the latter was declared unconstitutional the whole program of unemployment compensation would collapse; whereas, even if the tax "off-set" method was finally rejected by the Supreme Court, the states would, in the meantime, have passed Acts that would remain effective.

Another deciding factor lay in the oft repeated viewpoint of President Roosevelt, who made clear his recognition of the fact that whatever plan might be adopted must necessarily be more or less a temporary expedient, subject to change and revision in the light of experience. He strongly urged that the several states be given wide latitude for experimentation and expressed his belief that the 48 states should be regarded as laboratories or proving grounds for the testing of the many theories, alternatives and distinctions that have been advocated or suggested.

In the foregoing, I have tried to explain how it happens that under an all-important Federal Statute each of the several states is left virtually free to enact the type of employment compensation legislation best adapted to the philosophy of its people and to its particular economic and social conditions.[1]

ALTERNATIVE PROPOSALS

All that a State has to do to meet Federal requirements is to conform to a few simple rules concerning eligibility for benefit. No standards whatever have been set for the really vital considerations of any unemployment compensation plan. We shall now, therefore, enumerate the more significant matters upon which the states are free to legislate and consider the advantages and disadvantages of various more or less standard alternative proposals.

Contributions to unemployment compensation funds can come from three sources . . . the state, the employer and the employee. The Federal Act makes mandatory an eventual 3 percent of payroll contribution by all eligible employers but leaves to the discretion of the several states the question as to whether workers, or the state itself, or both, shall also participate in the cost of the program. So far as I know, none of the existing state laws provide for any contributions by the state; while about half require employee con-

tributions and in the remaining states the total cost is borne by employers. One of the first points to be considered then, is whether the workers should be taxed.

It is contended by those who oppose employee contributions that the employer should bear the total burden for three principal reasons:

First; because unemployment compensation is a proper charge against the costs of production and distribution and should, therefore, be included in selling prices.

Second; because the workers (on account of benefit limitations) must, in any event, bear the major part of the cost of unemployment and cannot shift their contributions to consumers or workers as employers are presumed to be able to do.

Third; because unemployment is largely preventable and its prevention is dependent upon the resource and ingenuity of the employer; while the worker can do practically nothing to control it.

On the other hand, it is felt by certain groups that the worker should make some sort of a contribution to the fund. The employee will then be entitled to a real voice in the administration of the program and will not consider the plan a gratuity. Labor will have a definite interest in the conservation of the fund, with less possibility of political raiding and malingering. It is further contended that employee contributions are the best possible safeguard against unreasonable increases in benefits and it has been suggested that the most logical method of keeping employer contributions within the bounds of reason is to provide that contributions of the workers shall always equal one-third or one-half the employer rate.

The most important decision to be made in the development of a state plan is whether the employer's tax rate is to be based in any way upon his own experience or whether all employers are to pay at the same rate.

Generally speaking, there are three types of plans, each with its enthusiastic adherents. There is, and has been, more controversy over the "type of fund" than all other unemployment compensation considerations combined, and failure of varied interests to get together on this point is responsible for the delay in enactment of statutes now pending before the Legislatures of several states.

The three plans referred to are typified by the laws of New York, Wisconsin and California.

The New York Act has a pooled fund composed of all contributions and the source of all benefits. This scheme contemplates that the

contributions of all employers shall be commingled and that benefits shall be paid to unemployed workers without regard for the tax payments made by their individual employers.

The Wisconsin Act is characterized by a system of individual employer accounts. All contributions by a given employer are credited to his own account, from which payments of benefits are made to his own workers who become unemployed. The employer bears no responsibility for benefit payments to other than his own workers, and does not hold his own reserve funds or has no control over their investment or liquidation.

The California Act provides for a partial-pooling device which is a compromise between the fund type provisions incorporated in the New York and Wisconsin laws. It contemplates that every employer shall maintain his own account in a general fund, from which shall be paid all the benefit claims of his own workers. In addition to such contributions as are necessary to maintain his own reserve account at prescribed levels, after payment of benefits to his own employees, the employer makes a relatively small direct contribution to a pooled fund. This additional contribution by the employer to the pooled fund, in turn, entitles workers to benefit payments from the pool fund if and when the individual reserve account of any particular employer has become so depleted as to be no longer capable of meeting benefit payment obligations.

This provision for a direct contribution by each employer to the pool fund is designed, therefore, to protect employees of companies who do not or cannot stabilize and who, in consequence, will not accumulate a sufficient reserve to assure the payment of benefits under all conditions.

The arguments in favor of the completely pooled fund are generally advanced by those who have had no practical experience, either in business or with unemployment benefit plans. They assert that the very nature of any insurance scheme contemplates spreading the resources of the many to cover the hazards of the few and further, that so little can be done in regard to stabilization that there is no value in offering an incentive to stabilize.

Conversely, the advocates of a system of individual employer accounts contend that experience in England and Germany proves that pooled funds are not sound and claim them to be a fair-weather luxury . . . a parasol rather than an umbrella . . . that they are inherently insolvent and afford only a minimum of protection to the

worker at times when protection is needed most. Further, that the source of pooled funds is distant, impersonal and invisible to contributors and beneficiaries alike. No party at interest has a direct self-interest in exercising proper control of the fund until insolvency is at hand. In consideration of these inherent characteristics of pools, pressure groups do have a definite interest in demanding more and more benefits; and experience has shown that there is liable to be created, sooner or later, a condition whereby the pooled fund becomes diminished to such an extent during periods of prosperity, that it is incapable of satisfying the demands made upon it even during the course of a relatively mild depression or the early stages of a major depression.

The proponents of individual reserve accounts and the partial-pooling device, as incorporated in the Wisconsin, California and New Hampshire Acts, attach great importance to the possibilities of regularization and improved efficiency in employee relationships, provided a financial and psychological incentive is presented. The incentive proposed under the terms of these (and some of the other state acts) consists of an employer contribution rate which decreases as the reserve accumulates, providing that the more regular an employer's operations the less his current financial burden for unemployment compensation. Because of the importance of this principle I am going to read you the applicable section of the California Act:

"Section 39. The commission shall, beginning in 1941, classify employers in accordance with the actual experience with regard to the contributions which they have paid in their own behalf and the benefits which the unemployment fund has paid to their employees, or to employees whose benefits are charged against such employers. If it appears in the accounts established and kept as provided below, that an employer shows an excess of contributions paid in his own behalf over benefits paid to his employees or chargeable to him, a reserve equal to eight per cent or more of the average of his total payrolls for the three preceding years, or the five preceding years whichever is higher, his rate of contribution shall be reduced to two and one-half per cent; if the reserve is ten per cent but less than twelve per cent, the rate shall be reduced to two per cent; if the reserve is twelve per cent but less than fifteen per cent, the rate shall be one and one-half per cent; and if the reserve is fifteen per cent or more, the rate shall be one per cent. The minimum contribution thus payable to the fund by the employer in his own behalf shall in no case amount to less than one per cent."

In assuming that at least a part of existing unemployment can be eliminated if those in control of industrial operations really tackle

the job, and apply as much resource and inventiveness to this as to other technical and marketing problems, advocates of separate accounts and partial-pooling point out that a scattering of employers have already definitely demonstrated the feasibility of regular operation. Outstanding perhaps is the experience of the Eastman Kodak Company, which has had a private unemployment compensation plan in operation since 1931. In the Eastman Rochester plant, a record is kept of benefits paid by departments and the department head and plant manager naturally do not like to have benefits paid to employees for which the company receives no return. The departments are, in consequence, making a more intelligent use of planning and statistical services and in other ways constantly striving to stabilize employment. The results have been most satisfactory.

As before noted, the respective advantages and disadvantages of these several types of fund provisions are at this time the subject of much controversy and if the Federal and State laws are sustained, these differing proposals will soon be subjected to the test of actual experience.

In all unemployment compensation laws there is a waiting period following discharge or lay-off during which no compensation is payable. In European laws, the waiting period is usually a week or less; in this country, most commonly three or four weeks in any year . . . by which is meant that once an employee has been unemployed for the duration of the specified waiting period (for which he is not compensated) he can draw benefits from the first day should be again become unemployed during such year.

The matter of the determination of the length of the waiting period is very important because of its effect upon the fund. A short waiting period is desirable if it is intended that an unemployment compensation plan shall have as its primary purpose the payment of benefits to casuals or workers intermittently employed during periods of prosperity. If, however, the plan is being designed primarily to provide a measure of security for those wage-earners regularly employed except during depressions; then the waiting period should be extended so as to conserve the fund and make possible the payment of benefits to regular employees during periods of serious and widespread unemployment.

It should be thoroughly understood that unemployment compensation is an institution providing only for *partial* and *limited* compensation to involuntarily unemployed workmen. In all of the

plans adopted both in this country and abroad the benefit provisions are designed to cover only a part of the wage loss and for a definitely limited period.

In some laws, persons who voluntarily quit employment or who have been discharged for misconduct are permanently barred from receiving any compensation, but more generally they are penalized only by a longer waiting period. In all cases, regardless of how the unemployment may have originated, the worker loses his rights to benefits if he refuses to accept other work, provided it is "suitable." What constitutes "suitable" employment depends upon many factors, but can be described briefly as work which the applicant can do, which imposes no extreme hardships upon him, and which offers standard wages and conditions.

It will be readily understood that the matter of deciding whether an interpretation of "suitable" employment contemplates that an unemployed worker be required to accept only work in his own occupation, which pays as well as that which he was performing prior to unemployment, or work under different conditions which pays the going wage for the new work is one apt to cause much difference of opinion. In practical application it is expected that applicants for benefits may justifiably refuse work which pays "substantially" less than the going rate, or which has substantially poorer working conditions, and still be eligible for benefit. The States however, cannot reasonably be expected to pay benefits to workers who refuse employment which is only slightly less favorable than that formerly engaged in. It will be possible for the states to set up a "zone of tolerance" which will provide reasonable flexibility. Within this zone, a worker may be asked to take employment and if he refuses he may be denied benefits. Within this "zone of tolerance" whose width will depend upon the definition which is given the word "substantial," there may therefore be adjustments of wages, which in periods of distress may serve to lower costs and permit plants, which might otherwise reduce operations, to go on. But the workers are, however, protected from any severe exploitation by the requirement that if the unfavorable difference between the proffered job, and the job formerly held, or jobs similar to it in the locality is "substantial"; the states must permit the unemployed person to refuse it, and still draw benefit.

Everywhere the compensation to an unemployed worker is restricted to a part of the wages which he earned while employed and

for a limited period. Obviously, these limitations are necessary; first, for the protection of the fund and; second, to encourage an active quest for other work on the part of beneficiaries.

In this connection, we quote Mrs. Sidney Webb, one of England's foremost Social Security authorities, as follows:

> "The fundamental drawback to all unemployment insurance is that its weekly 'out-of-work' pay cannot . . . at least in the present organization of society . . . safely be made large enough to completely maintain either the unemployed men or their families. All experience shows that it is fatal to offer as 'out-of-work' pay anything like the same sum as the workman would receive if he were employed."

In the great majority of American laws enacted to date benefits are provided for at the rate of 50 percent of prior earnings, with specified minimum and maximum limitations. The customary maximum is fifteen dollars per week and the most frequent minimum is five dollars for total unemployment.

In all unemployment compensation statutes, the period during which benefits can be drawn is related in some manner to the time the employee worked before becoming unemployed. Two types of limitations of the duration of benefits are included in our American laws. One of these is a ratio of weeks of benefits to weeks of employment; the other an absolute maximum number of weeks for which benefits may be drawn during any year. The most common ratios of benefits to employment are one to three or one to four; that is, the maximum number of weeks for which benefits may be drawn may not exceed one-third or one-fourth of the number of weeks of employment within the year or two years preceding unemployment. The most common absolute limitation is sixteen weeks of benefits during any year, with one law establishing a maximum of twenty weeks and another of thirteen weeks. In about half of the new American Acts, there are also provisions similar to those in the present British Act for additional weeks of benefit beyond those specified to employees who have been employed for a long period without having made any withdrawals from the reserve fund.

To sum up the subject of benefit provisions . . . a sound plan would appear to be one which provides a three or four weeks waiting period with a maximum of sixteen or thirteen weeks of benefit in one year. If employee contributions are contemplated, these terms might safely be liberalized. Rates of 50 percent of normal wages, subject to a maximum of $15 per week are generally considered sound.

The unemployment compensation title of the Federal Social Security Act applies to employers of eight or more workers in each of twenty weeks during the taxable year. Certain classifications, such as agricultural workers, domestic servants, and governmental employees are exempt. It stands to reason that administrative procedure will be greatly simplified if a state in the beginning, at least, adopts coverage requirements identical with those of the Federal Act. After administrative machinery has been set up and is functioning smoothly, the coverage could gradually be broadened to include employers of four, or even one or more workers.

Unfortunately, in my opinion, the Federal tax applies to the *total* payroll. In the Old-Age Retirement Benefit Section of the Federal Act, only the first $3,000 of salary is taxed. It might be well for the states to uniformly adopt this same arrangement for unemployment compensation. Under a plan of this kind, the employer would not, in the meantime, receive the full amount of the credit to his reserve account to which he is entitled and a larger proportion of the tax would be held in Washington. It is reasonable to expect, however, that if a substantial number of the states enact or amend laws limiting taxation to the first $2,500 or $3,000 of salary, the Federal Act will eventually undergo a sympathetic change.

In the last analysis the success or failure of a system of unemployment compensation will depend upon the quality of its administration. Administrative machinery that thoughtlessly places obstacles in the way of the free movement of labor from occupation to occupation or from industry to industry, or will utilize its prerogatives to hamper the operations of business may well create more problems than it solves. In the management of a project so far-reaching and with as little precedent as one of the new state unemployment compensation systems, there is much to be said against any policy of administration that, early in its history, becomes rigid and content with the mere application of a code of formal regulations. It is essential, lest the plan defeat its own purposes, that management be invested from the outset with a high degree of flexibility and the capacity to adjust itself readily to new and unforseen conditions.

Some of the state laws provide that administrative responsibility and authority shall be centered in one official, while others provide for administrative control by boards or commissions. It seems to me that the advantages of the commission plan are self-evident and that a state law should specifically provide for a commission of three

or five members (depending upon the size of the state); these members to be representatives of labor, industry and the people of the state at large.

Even those most enthusiastic in their support of unemployment compensation recognize that the legislation in its present form may not prove workable in every particular. In the initial stages of administration, especially, there will doubtless occur instances of what may appear to be discrimination and unfairness. It is only through actual operation, however, that there will come opportunity for experimentation which will demonstrate the probable advisability of certain changes in the various state laws and the Federal Act. In the meantime, it is to be hoped that everyone concerned will adopt a constructive attitude to the end that unemployment compensation in the United States will provide a protection to both industry and the worker against the disastrous social and economic effects of depression and unemployment in future years.

PRESENT STATUS OF THE ELECTRICAL GROUNDING PROBLEM AS RELATED TO THE FORMATION OF THE AMERICAN RESEARCH COMMITTEE ON GROUNDING[1]

By M. W. Cowles

(Health Officer, Hackensack Water Company, New Milford, N. J.)

You will recall that at the 1935 Convention of this Association at Cincinnati, a resolution was passed rescinding official permission to attach ground wires to water pipe systems. On the representation of the electrical group that grounding of electrical circuits was necessary to prevent hazard to life and property and on the assumption that these protective grounds would carry no current except in emergency, the Association in 1920 approved the principle of grounding. It became evident that ground wires did carry current and in 1927, a resolution was passed, permitting grounding but with the provision that the protective grounds should not carry currents. The resolution of 1935 has been largely responsible for a definite crystallization of ideas, current in certain electrical and other groups, who realized that some mutually agreeable solution of the increasingly complex and intricate problem of proper grounding of electrical circuits must be undertaken.

For many years there has been a widespread and ever increasing dissatisfaction with the existing grounding procedure. Relatively little progress has been made partly on account of the lack of accurate basic data on existing conditions, which obviously is an essential part of any proper and reasonable change which might be made in the grounding provisions of the National Electrical Code. Minor changes have been suggested at regular intervals and some of these have been adopted but these changes have not materially altered the essential elements in the situation.

Extensive revisions of certain features of the Electrical Code were proposed in the 1935 Session of the Electrical Committee. You

[1] Presented for the A. W. W. A. Committee on Electrolysis and Electrical Interference.

may recall that this Association did not have direct representation on the Electrical Committee, but was represented on the Article IX Committee on Grounding, and our representatives opposed some of these revisions because we felt that the amount of current on the water pipe system might be increased. The 1935 Code as adopted by the Electrical Committee was submitted to the American Standards Association for approval. The American Water Works Association could not approve the grounding provision of the Code as written by reason of the 1935 resolution. The National Association of Master Plumbers and the National Association of Sanitary Engineers was also opposed to the grounding provision of the proposed Code. The provisions of the Code, as far as grounding was concerned, were practically the same as the provisions in the 1933 Code and our continued opposition would have resulted in the continuation of the 1933 Code without any particular benefit to the water works operators and with a distinct hardship to the electrical groups. In the discussions which followed the submission of the 1935 Code to the A. S. A. members, the idea was advanced that the A. W. W. A. might withdraw its opposition to the proposed Code, provided however that the whole question of grounding be referred to a committee of representatives from national organizations for detailed study in a fair, impartial and scientific manner. Your Electrolysis Committee was agreeable to such a proposal and the A. W. W. A. withdrew its opposition to A. S. A. approval of the Code. This action did not in any way nullify the 1935 resolution.

Over a period of several years informal approaches had been made by several different groups with the idea of the formation of a joint committee. The activities of your Electrolysis Committee during the several years past has indicated very clearly that a satisfactory solution of the problem could only be obtained through the conference method. Your committee on Electrolysis and Electrical Interference has taken a very definite part in the developments that have led up to the formation of the more or less independent joint committee which will be referred to more in detail.

Through the cordial coöperation of the American Standards Association and the Edison Electric Institute representing a large percentage of the electric light and power distribution agencies informal conferences with your Committee on Electrolysis were made possible. Definite evidence of interest appeared in other groups, accompanied by a renewed realization that previous attempts at code changes had

accomplished little or nothing, as far as the solution of the grounding problem was concerned. Toward the latter part of November, 1935, it was mutually decided that the American Water Works Association and the Edison Electric Institute, as the two organizations most directly and vitally concerned with the grounding problem, would jointly invite representatives of other interested groups to meet together for the purpose of discussing the situation with the hope that the meeting might agree to some form of permanent organization for this specific purpose. The procedure for this joint invitation was approved by your Committee on Water Works Practice at its meeting in New York City on January 16, 1936. Invitations were then sent out to the officers of some sixteen national organizations which were thought to be interested in the grounding problem, asking them to appoint representatives to attend a joint meeting. The list included associations representing the electrical engineers as a profession, the electrical inspectors, the railroad and street railway groups, the gas distribution group, the telephone group, the fire insurance group and the plumber groups and the National Bureau of Standards.

The first meeting of the representatives of these several groups was held in New York City on March 17, 1936, with Mr. Maxwell, of the Edison Electric Institute acting as temporary chairman. There were more than twenty persons present as organization representatives, either temporary or duly appointed, and several others who asked permission to attend as observers. During the all day session, the discussion was on a very frank basis with a decided note of cordiality toward the viewpoint and experiences of the other representatives, a pleasant contrast to many other meetings which members of our Committee had attended on the subject of grounding. The broad scope of the problem before the group was well recognized. There was a decided willingness to coöperate to the fullest extent. It seems extremely significant that the discussion brought out several phases of the problems involved which were new even to some of us who were somewhat familiar with the general situation.

In an effort to determine and define the scope of the Committee, the following resolution was unanimously passed:

"To investigate and report upon, as conclusively as may be: (a) Electrical grounding connections, made to water, gas or drainage pipes, with respect to the effects of any kinds of electrical current thereby caused to flow, upon (1) the pipes, (2) the contents of the pipes, and (3) fire and personal hazards;

(b) conditions in the electrical circuits involved which produce current flow over pipes; (c) measurement of stray currents; (d) efficiency of electrical grounding."

After some discussion, it was decided that the committee should be known as the "American Research Committee on Grounding." The general form of organization proposed more or less follows that of the now disbanded American Committee on Electrolysis on which this Association was represented, and to which financial contributions were made. The work of this former national committee has made available many methods of preventing damage to underground structures by stray direct current. It is intended that the work of this new research committee on grounding will be done for the most part by smaller sub-committees of trained personnel who in turn will report their findings back to the main committee for their consideration.

Provision was also made for the appointment of a Technical Sub-Committee which was to consist of representatives of the groups more directly concerned with the grounding problem; A. W. W. A., Edison Electric Institute, American Gas Association, A. S. A. telephone group and the master plumbers organizations, together with the Bureau of Standards. This committee was instructed to prepare a program of activities to be undertaken, based on the resolution which has been given above.

Other sub-committees will doubtless be formed after the main features of the suggested program of activities have been approved by the main committee, which program will be presented to the Research Committee at its next meeting on June 18, 1936.

You would be doubtless interested in the membership of the Research Committee. The two sponsoring organizations, the Edison Electric Institute and the American Water Works Association most vitally concerned with the problem of grounding are to have three members each. Your representatives, as appointed by the Committee on Water Works practice are Nicholas S. Hill, Jr., Charles F. Meyerherm, and the speaker. Other participating organizations will each have one representative. The total membership of the main committee will be approximately 20.

Mr. H. S. Warren of the Telephone group, was chosen as Chairman of the Research Committee and Chairman of the Technical Sub-committee by reason of his knowledge of the problems involved in grounding, and his sense of fairness and impartiality in connection

with the discussions that will doubtless arise in the committee. Mr. Warren has been chairman for a number of years, of the Article IX Committee on Grounding, one of the sub-committees which assists in preparing the National Electrical Code and for many years he was chairman of the Research Sub-Committee of the American Committee on Electrolysis. Charles F. Meyerherm, an A. W. W. A. representative, was chosen as Secretary-Treasurer.

The question of funds necessary for proper functioning of this Grounding Research Committee was discussed in considerable detail. It was decided that each of the organizations represented on the committee would make a contribution of from $50 to $200 per year for general committee expenses, and that the organizations represented on the technical subcommittee would make additional contributions of money and/or services for the field work. As the work progresses, the Committee will doubtless set up a Research Fund, which would further supplement the field work and contributions in money or services from various organizations interested in the problem. Until such time as the program of work outlined by the Technical Sub-Committee has been approved and is actually under way, it is difficult to estimate the amount of money that may be required for the Research Fund. At a later date, it may be necessary for your Committee on Electrolysis to approach water works organizations for contributions for this purpose.

At the first meeting of the Technical Sub-Committee held on May 18, 1936, under the chairmanship of Mr. Warren, a tentative program was discussed, subject to further consideration at the next meeting on June 8, 1936. It was thought that the subject should be divided into two more or less distinct parts (a) collection of all available basic data in some proper form from each of the several groups on the committee, to be accompanied by a statement of the difficulties encountered with the grounding provisions of the Code as it now exists; and (b) the necessary investigation and research to supplement the basic data already obtained. An effort will be made to obtain material from any and all sources, which material might have a bearing on some phase of the grounding problem. From the basic data and the results of carefully directed research, certain definite conclusions can be gradually drawn and submitted in the form of written reports. Considerable time will be required in both phases of the Committee's activities and it is proposed to so coördinate these two phases that the maximum amount of progress can be made

within a reasonable time. Thoroughness in the study is more essential than a hasty report. It is expected that, if the members of the Research Committee cannot completely agree on some particular phase of the problem no report will be submitted, and therefore any reports made by the committee will have the unanimous approval of all of its members. Disputed questions will be given further study. Revisions in the National Electrical Code may follow the reports of this Committee, but changes in the Code itself are considered to be the duty and function of the Electrical Committee.

The collection of basic data will necessarily involve a survey in some properly standardized form, of conditions as they actually exist in the field. Wherever complaints of objectionable conditions are reported, it is the intention of members of the Technical Sub-committee to personally investigate any such situations in order to become thoroughly familiar with actual field conditions. It may then be possible to standardize the necessary inspection procedure so that any reports made to the Committee from various parts of the country may be uniform and equally accurate.

The general purpose of this paper is to inform the membership of this Association of the activities of your Committee on Electrolysis which have led up to the formation of the American Research Committee on Grounding. It appears that stray electric currents both alternating and direct may be found on water pipe systems rather more generally than was thought possible and each and every water works operator may be sooner or later effected, depending on the amount of current flowing and its characteristics. The hearty coöperation of all water works managers and operators will be essential if the various sub-committees are to secure the necessary field data in connection with particular situations, which are reported to the Research Committee. Statistical information may also be required. Actual records of difficulty with electrical circuits or ground wires which involve shock or sparking when disconnecting water meters or repairing of mains, damage to mains, services or interior piping systems thought to be due to electric current flow, evidence of deterioration of the quality of water flowing in service pipes, or interior piping systems as compared with the quality of water in the mains, particularly in regard to changes in color, odor or taste, should be reported to the Committee as promptly as possible.

In this connection, water works operators must bear in mind that

corrosion of pipes and changes in the quality of water may result from a rather wide variety of causes, some of which have no relation to the presence or absence of currents on mains, services or interior water piping. Inadequate circulation may produce unsatisfactory quality of water in the mains as well as that delivered from taps. Improper plumbing fixtures may occasionally back-siphon under favorable conditions. If the water works operator has investigated all other possible causes which he can think of on the premises and at other houses in the vicinity, then naturally he may suspect that electric current may be the cause.

The Committee realizes that few, if any, water works operators have the equipment necessary for the making of proper electrical tests and some procedure will have to be devised by the Committee so that essential preliminary information can be submitted on a more or less uniform basis. Incomplete information is of relatively little value and in some proper way yet to be determined, the needed information will be secured through the use of personnel, trained in this work. It is expected that the facilities of the several coöperating national organizations may be used for this purpose so that the real "evidence" can be readily secured. Until such time as a standardized procedure or report form can be devised, your Committee on Electrolysis would earnestly urge that any abnormal or unusual conditions in which electric current is apparently involved, be reported to Mr. C. F. Meyerherm, the Secretary and Treasurer of the American Research Committee on Grounding at 511 Fifth Avenue, New York City.

CONCLUDING REMARKS

The attitude of the members of the American Research Committee on Grounding has thus far been most cordial with a willingness to coöperate in solving a very complex yet common problem. It is the hope of your representatives on this Committee that each and every water works operator will realize that he has an essential part in this coöperative program. Nothing can be gained by hasty, arbitrary or unreasonable action in any particular situation because of the complicated technical, legal and practical considerations involved. An adequate study of the complex problems involved in the grounding of electrical systems may require several years of work along widely divergent lines so that an immediate solution cannot be expected.

RESIDUAL CHLORINATION ON THE LOS ANGELES SYSTEM

By R. F. Goudey

(*Sanitary Engineer, Bureau of Water Works and Supply, Los Angeles, Calif.*)

The first residual chlorination unit on the Los Angeles water system was furnished by Wallace and Tiernan Company, Inc. and operated from October, 1932 to August, 1933 at the Franklin Canyon Chlorination Station. This station was equipped with four vacuum type chlorinators, three of which operated automatically from a Venturi meter with hourly flows varying from 8 to 50 m.g.d. and the fourth chlorinator with the residual control unit trimmed the chlorine dose for minor adjustments in flow and for changes in chlorine demand. During this period several mechanical difficulties developed and with the joint aid of the Mechanical Engineering Division of the Bureau of Water Works and Supply, and engineers of the Wallace and Tiernan Company several fundamental weaknesses n the original design were overcome and specifications were drawn up for a new and better unit.

An improved machine was purchased and installed at the 72-inch outlet at Lower San Fernando Reservoir on November 19, 1934. The San Fernando Chlorination Station treats both a 72-inch and a 54-inch line with eight 300 pound vacuum type chlorinators automatically operated from Venturi meters. The hourly flow in the 72-inch line varies from 65 to 150 m.g.d. As in the previous case the residual chlorinator adjusts the dose on one of the vacuum chlorinators and trims the chlorine feed to maintain a fixed residual regardless of variations in water flow and chlorine demand. It is planned after several minor difficulties are overcome with the present equipment to purchase additional residual machines for duty elsewhere on the system.

NEED FOR RESIDUAL CONTROL

The general practice in the matter of fixing chlorination doses is arbitrarily to set a dose sufficiently high to meet the highest antici-

pated chlorine demand which might occur between times of expected visits to the plant. This requires guessing the anticipated maximum demand and undertreating with chlorine during periods when the chlorine demand is greater than the fixed dose. It has been generally and wrongly assumed that the daily variations in chlorine demand are not sufficiently great to jeopardize safe disinfection or to require frequent changing of doses.

Daily variations in chlorine demand are due to temperature changes, increase in turbidity from storm drainage, roiling up of the water due to wind action or currents, and from algae growths. As the records of the residual chlorination unit accumulate it is evident that the ordinary fluctuations in chlorine demand are far greater than is generally recognized. An operator is usually satisfied with making one or two checks on residual chlorine below the chlorinator a day. A residual chlorine machine makes a residual test every three minutes throughout each twenty-four hour period. The chlorine demand may vary 100 percent during the season and in any one day has varied from 2.4 to 4.3 pounds per m.g. which represents an increase of 79 percent. The adjustments to the seasonal variations are easily made by manual operation but the hourly fluctuations are frequently missed. It is quite evident that where constant dosages are used there may be considerable periods of time when chlorine demand requirements are insufficient to secure disinfection, whereas at other times there may be tastes and odors created by excessive chlorination. Residual control of chlorination insures proper disinfection at all times with the danger from tastes and odors during periods of overdosing being reduced to a minimum.

GOOD MIXING OF CHLORINE ESSENTIAL

From the practical standpoint it is necessary to have a sample point for the residual machine relatively close by, but this sampling point must be sufficiently far down stream so that the mixing of chlorine in the water has become uniform. It was found at the Franklin Canyon installation with a single point of application, that 200 feet downstream the mixing of chlorine was quite uneven. In order to obtain proper mixing a nine point application through a special header manifold fed by duplicate lines was installed. This enabled the residual chlorinator to function properly but also secured the additional advantage of lowering the average dose from 3.5 to 2.25 pounds per m.g. A similar scheme of mixing chlorine solution

was installed at the Lower San Fernando Chlorination Station where the dosage was decreased from 5.5 to 2.75 pounds per m.g.

A pitometer survey was made in the 72-inch line of a 24 point cross section 1000 feet downstream before and after adequate mixing was secured. With but one point of application the residual varied from 0.8 to 2.0 pound per m.g. but with the new header it varied from 0.6 to 1.0 pound per m.g. The effect of improved mixing was further demonstrated on the 54-inch line where chlorine variations 1000 feet below the chlorinator as measured at 16 points in the cross section varied from 0.8 to 2.0 pounds per m.g., but after the header was installed the residual chlorine was constant at 0.8 pound per m.g. Good mixing of chlorine with water permits a minimum dose of chlorine to be used and thereby lessens dangers from chlorinous tastes, but, what is more important, uniform mixing is absolutely essential to secure satisfactory control with residual equipment.

DESCRIPTION OF RESIDUAL CONTROL EQUIPMENT

The residual chlorination unit consists of three separate pieces of equipment. The first is a device which measures the actual residual chlorine every three minutes and produces a mechanical motion proportional to the increase or decrease of chlorine dosage necessary to maintain a fixed chlorine residual. The second part is a control device which converts the amount of mechanical motion established by the first unit to a proportional change on the vacuum side of the chlorinator orifice sufficient in amount to trim the dosage to secure the desired fixed residual. This control device takes the place of a converter usually employed on Venturi operated automatic chlorinators. The third part of residual control equipment is a recording device to register the increase or decrease of chlorine dosage, as well as to record the periods at which residual tests are actually made.

A continuously running stream of water is brought from 300 feet downstream to the residual control equipment. Two testing cells are automatically filled with treated water by a partial vacuum built up previously by an aspirator. One test cell is automatically dosed with hydrochloric acid and ortho tolidin solution in the required amounts and the second test cell has a colored disc equal to the intensity of yellow color represented by the residual which it is desired to maintain in the water. This cell is filled with water but is not dosed with acid or ortho tolidin so it can be used to correct for turbidity and color. After the samples are tested the test cells

are automatically drained, washed, rinsed, and made ready for a subsequent test.

The testing is made by a "photoglow" tube. A "photoglow" tube is one in which no current passes until sufficient light is directed through its window. When this light intensity is reached the "photo-

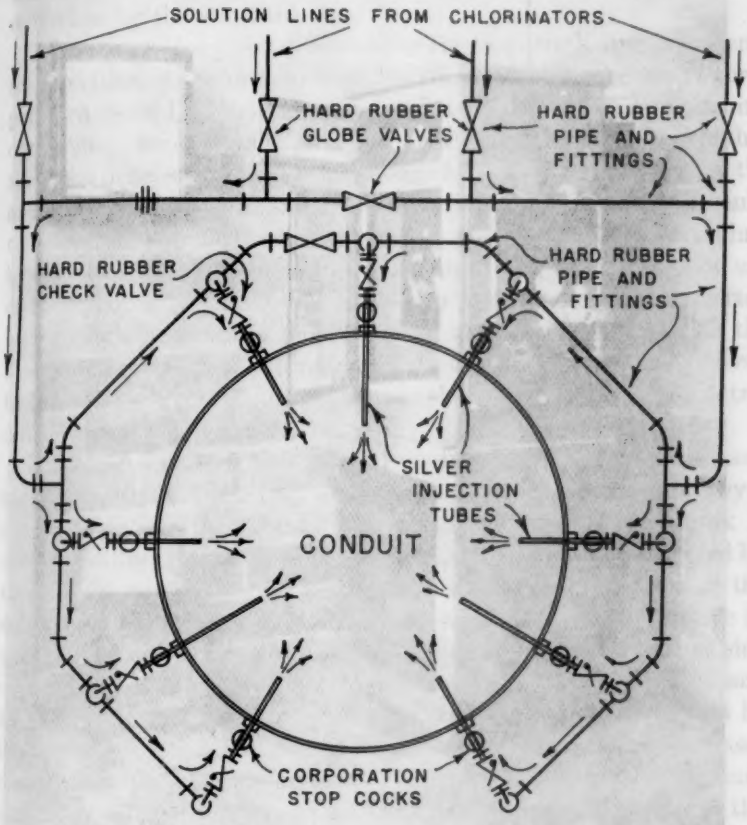

FIG. 1. CHLORINE SOLUTION INJECTION HEADER
Good mixing is essential for residual control

glow" tube suddenly passes a relatively large amount of 200 volt current. When the "photoglow" tube is ready to measure the amount of residual in a test cell a small 6 volt light in back of the test cell increases in intensity by a variable resistance produced by a cam operated solenoid coil until the "photoglow" tube passes a

current or "fires." The increase of light intensity represents a varying electrical resistance. There is geared to this cam two clutch

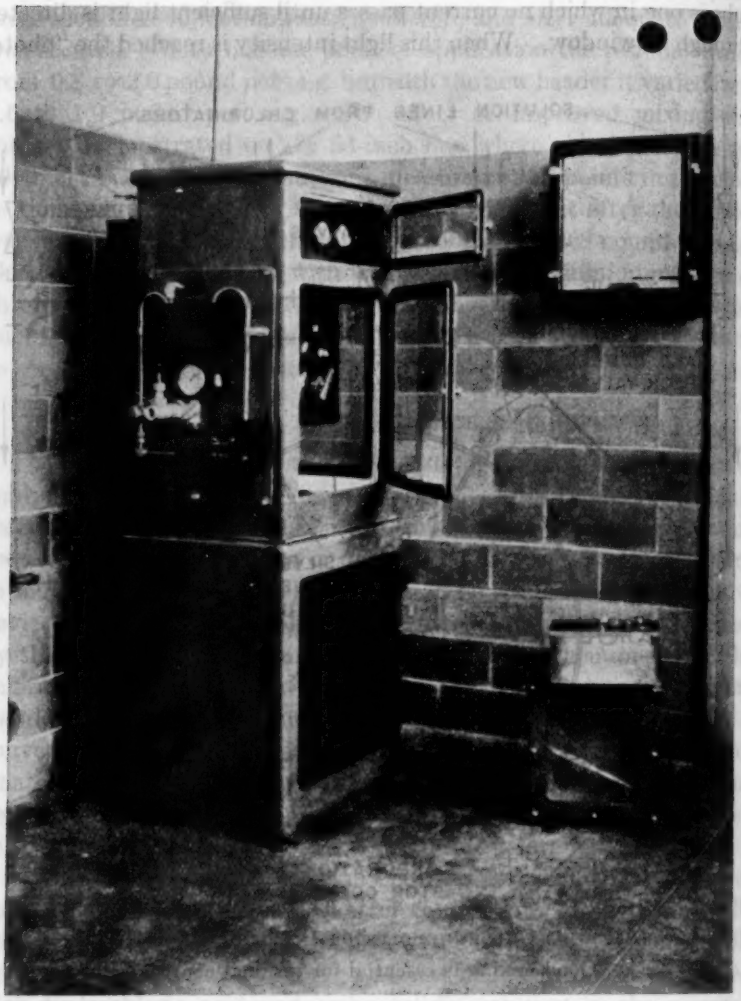

FIG. 2. ASSEMBLY RESIDUAL MACHINE CONTROL DEVICE AND RECORDING CHART

plates. One clutch is engaged the instant the light is turned on and revolves until "photoglow" tube fires. The light is then turned

off and the clutch arm drops. In this manner the clutch has been turned through an angle which measures the color intensity of the sample. The standard cell which has the blank sample and the colored disc is then moved between the light globe and the "photoglow" tube. The light again increases in intensity till the "photoglow" tube fires. This revolves the second clutch giving an angular difference for the standard.

The amount of angular difference on the two clutch arms represents the deviation of the sample from the standard. By the use of three pole switches a 110 volt current is made to flow in either two circuits, one giving one direction and one another, depending on whether there is a deficiency or an excess dosage for a time represented by the angular differences of the clutches. The residual control unit, therefore, measures colorimetrically the amount of chlorine residual by the electrical differences in the standard and the test cell by use of the "photoglow" tube. These electrical differences are converted into a single mechanical motion. The time necessary to bring the mechanical motion back to zero is equal to the time in which a reversible motor in the control unit can make the adjustments in the control unit of the residual equipment.

The control unit of the residual equipment is a small tank containing part water and part air under a slight vacuum created by a continually operating aspirator. The air intake to this tank is through a tube, the submergence of which can be raised or lowered by the reversible motor previously mentioned and thereby change the amount of vacuum in the upper part of the tank. This change in vacuum is connected to the U-tube on the chlorine gas discharge side of a chlorinator which changes the head on the chlorine orifice and thereby adjusts the chlorine flow. If the chlorine dose needs to be increased this reversible motor lowers the tube and thereby increases the head on the chlorine orifice. The time represented by mechanical motion in the clutches to get back to their original setting is the time which this reversible motor operates to change the head on the orifice. If the chlorine dose needs to be decreased the reversible motor raises the intake tube for the period required to get the desired reduction.

The third part of the machine is a residual chlorine chart. Every time a residual test is made a mark is indicated on the chart which if on one side of a zero line means that the chlorine dose has been increased, or, if it is on the other side that the chlorine dose has been

FIG. 3. RESIDUAL CONTROL MACHINE PHOTOGLOW TUBE AND TEST CELLS IN TOP REVOLVING CLUTCHES WITH BARS HORIZONTAL SEEN AT LOWER FRONT

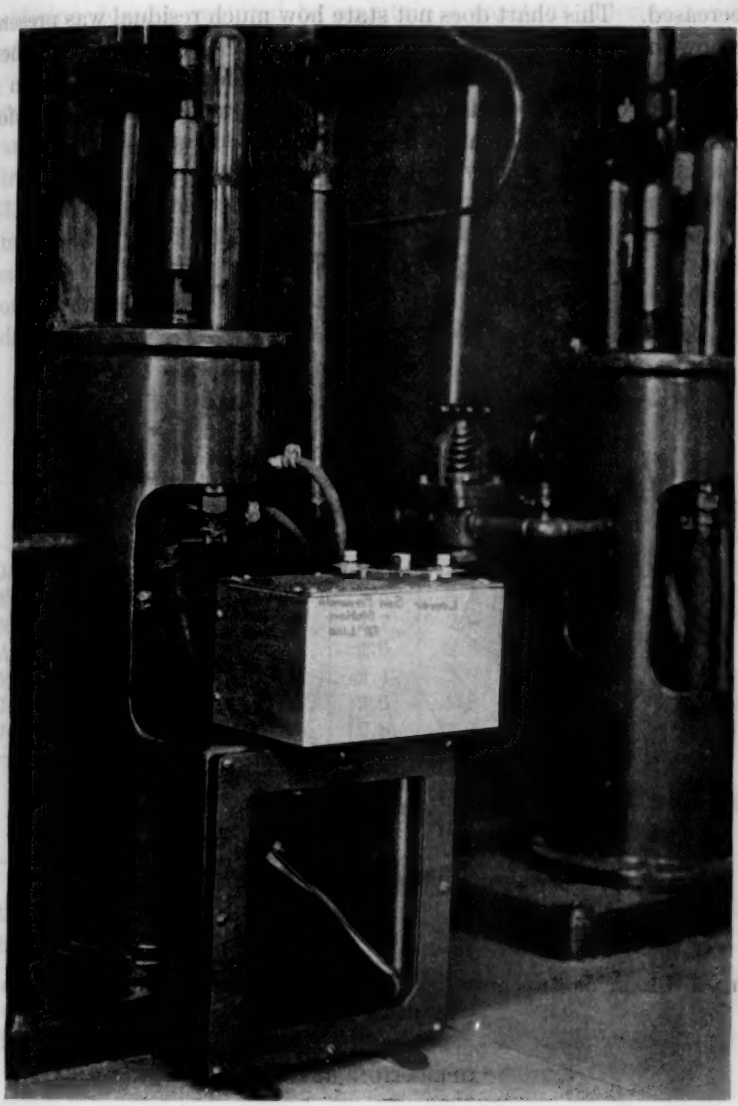

FIG. 4. CONTROL DEVICE WITH VARIABLE AIR INLET CHANGING HEAD ON CHLORINE ORIFICE TO CONTROL CHLORINE DOSAGE

decreased. This chart does not state how much residual was present or how much the chlorine dose was changed. It does indicate when the lines are all on one side whether the chlorine demand is on a major increase or decrease. At the present time there is need for considerable improvement in this chart.

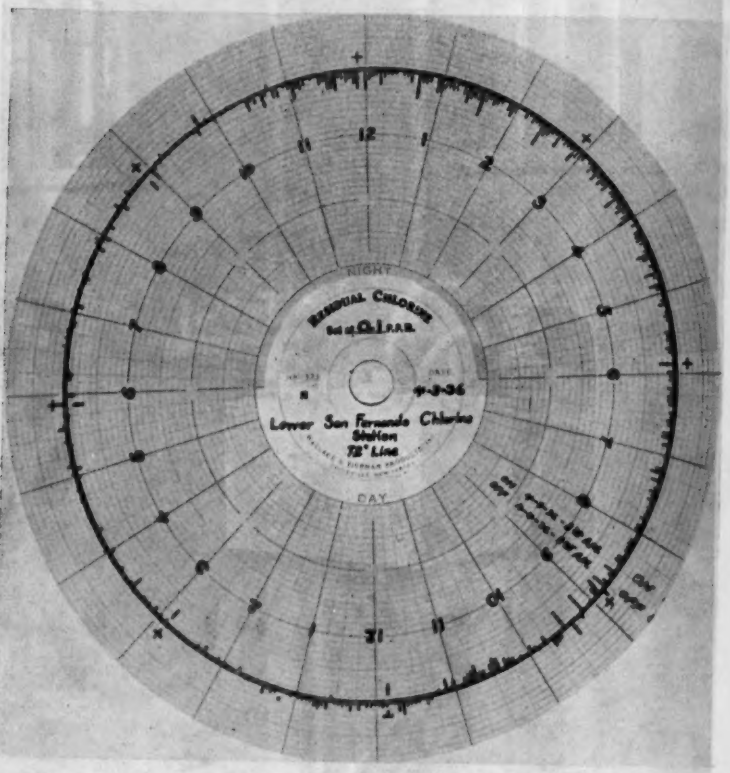

FIG. 5. CHART OF CHLORINE RESIDUAL SHOWING INCREASES AND DECREASES IN DOSAGES

OPERATION RESULTS

Franklin Canyon Reservoir

Operation at Franklin Canyon Reservoir was not satisfactory until proper mixing of chlorine was obtained on January 20, 1933. Over a six months period thereafter there were only three major mechanical failures. Table 1 gives the average, maximum, and minimum

chlorine dosages required to maintain a constant chlorine residual of 0.1 p.p.m.

Prior to the installation of the residual unit it was the practice to add a uniform dose of 3 pounds per m.g. chlorine in the summer and 4½ pounds per m.g. in the winter time. With the residual control machine the average summer dose was 2.6 and in the winter 3.3 pounds per m.g. It is thus apparent by residual operation that more adequate disinfection can be obtained with less chlorine. It is estimated that residual chlorination at this station saves $50 worth of chlorine per month. It was also noted that for 8 days the chlorine demand exceeded 3 pounds per m.g. when under manual control

TABLE 1

Residual chlorination—Franklin Reservoir

Chlorine dose—pounds per million gallons

MONTH 1933	AVERAGE MONTHLY	MAXIMUM DAY	MINIMUM DAY	MAXIMUM HOUR	MINIMUM HOUR
January	3.6	3.9	3.3	4.2	3.2
February	3.5	4.1	2.7	4.2	2.5
March	2.7	2.9	2.4	3.0	2.3
April	2.6	2.8	2.3	3.0	2.3
May	2.4	2.8	2.2	2.9	2.1
June	2.6	2.8	2.3	3.0	2.2
July	2.8	3.1	2.4	3.2	2.4
Average	2.9				
Maximum	3.6	4.1	3.3	4.2	3.2
Minimum	2.4	2.8	2.2	2.9	2.1

the set dose would have been 3 pounds per m.g. and chlorination at that time was inadequate.

Periods of high chlorine dosages invariably corresponded with increased turbidities due to rainfall. The minor increases in chlorine demand during June and July were due to a steady increase in water temperature with some fluctuations due to algal activities.

LOWER SAN FERNANDO RESERVOIR

The San Fernando residual chlorinator has had a remarkable record for continuity of service with no major mechanical failures. In thirteen months operation there has been but one interruption due to the breaking of a band on a rheostat. This caused the

machine to operate approximately three hours without a change in the dosage rate. This, however, was not serious because the automatic chlorinators kept the chlorine feed proportional to the flow. On June 1, 1936 the method of increasing the light intensity in front of the "photoglow" tube was changed from a rheostat device to a cam operated solenoid variable resistance doing away with further interruptions by the breaking of the band on the rheostat. On one occasion the clutch on the chart slipped making the record faulty.

TABLE 2

Residual chlorination—San Fernando 72-inch line

Chlorine dose—pounds per million gallons

1934-35	AVERAGE MONTHLY	MAXIMUM DAY	MINIMUM DAY	MAXIMUM HOUR	MINIMUM HOUR
December	3.7	4.5	3.1	5.0	3.0
January	3.8	4.3	2.6	4.6	2.5
February	3.0	4.6	2.3	4.7	1.9
March	2.2	2.5	2.0	2.7	1.8
April	2.4	3.2	1.9	3.4	1.7
May	2.4	2.7	2.1	3.2	2.0
1935-36					
November	2.8	3.7	2.0	3.8	1.8
December	2.1	2.5	1.8	2.7	1.8
January	2.5	3.1	2.6	3.4	2.0
February	2.1	3.8	2.3	3.9	2.0
March	3.0	3.8	2.3	3.9	2.2
April	2.8	3.5	2.5	3.8	2.4
Average	2.7	3.5	2.3		
Maximum	3.8	4.6		5.0	3.0
Minimum	2.1		1.8	2.7	1.7

There have been two occasions when the ortho tolidin line became choked and one when the acid line stopped up, but under these circumstances errors of dosage were on the safe side. Table 2 gives the variations in chlorine demand to maintain a constant residual of 0.1 p.p.m.

Fluctuations in the chlorine dosage at the San Fernando Plant are indicated by figure 6. The variation in chlorine demand has been from 1.7 to 5.0 pounds per m.g. It is noted that the chlorine

demand varied from 2.3 to 4.1 within a 4-day period and decreased by that same amount in a ten day period.

The minimum monthly dose based on good reservoir water is 2.1 pounds per m.g. although when the water is exceptionally free of algae the daily dose may drop to a daily rate of 1.8 pounds per m.g. Rainfall causing turbidity to be washed into the reservoirs above the chlorination station increases the dose proportional to the amount of rainfall. A 0.5 inch rain over a three day period has caused the average minimum dose of 2.1 pounds per m.g. to be increased to 2.5 pounds per m.g., whereas a rainfall of 3½ inches in a day period has required a chlorine increase up to 4.5 pounds per m.g. Heavy in-

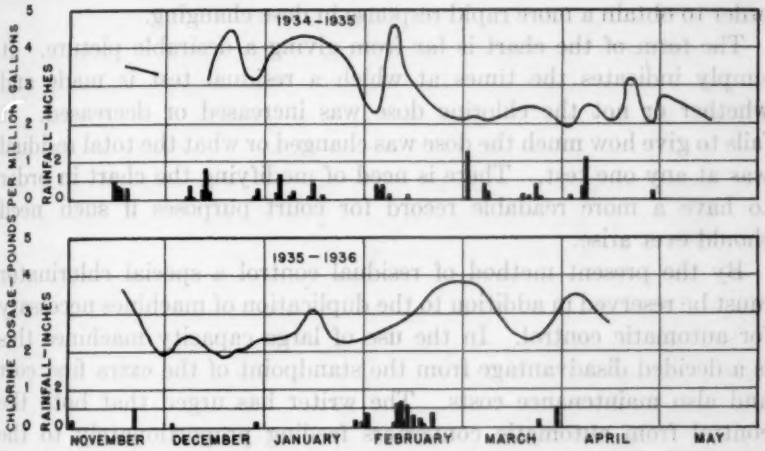

FIG. 6. OPERATION DATA RESIDUAL CHLORINATOR SAN FERNANDO RESERVOIR—72-INCH OUTLET

tensities with lower rainfall such as 1 inch in 24 hours have raised the dose from 2.1 to 3.5 pounds per m.g. and steady downpours of low intensities such as 2½ inches in 24 hours have increased the dose only from 2.1 to 2.35 pounds per m.g.

The larger increases in chlorine doses in all cases is correlated with rainfall. Heavy winds reaching a maximum on January 17, 1936 of 23 to 25 miles per hour stirred up the reservoir and raised the chlorine demand from 2.3 to 3.1 pounds per m.g. without any rainfall. On April 18, 1935 an increase in chlorine demand from 2.1 to 3.1 pounds per m.g. was due to the end products from a dying growth of Asterionella of about 500 standard units per cubic centimeter.

At the San Fernando Station the residual chlorinator effects a saving in dosage of 1 pound per m.g. which is equivalent to $125 a month when the treated flow averages 200 second feet.

NEEDED IMPROVEMENTS

While the operation of the present equipment is generally satisfactory there is need of making certain improvements. The time in which the reversible motor operates to raise or lower the dose is not sufficient to complete a dose change in one setting. It has been found that two or even three cycles are required to bring the dosage back to normal when the dosage rate has been deliberately changed. There is need for magnifying the action of the reversible motor in order to obtain a more rapid response in dose changing.

The form of the chart is far from giving a desirable picture. It simply indicates the times at which a residual test is made and whether or not the chlorine dose was increased or decreased. It fails to give how much the dose was changed or what the total residual was at any one test. There is need of modifying the chart in order to have a more readable record for court purposes if such need should ever arise.

By the present method of residual control a special chlorinator must be reserved in addition to the duplication of machines necessary for automatic control. In the use of large capacity machines this is a decided disadvantage from the standpoint of the extra first cost and also maintenance costs. The writer has urged that both the control from automatic converters feeding proportionately to the flow and the control from the residual unit act on one machine. Manufacturers can apparently secure this by the installation of an automatic valve, electrically operated, on the U-tube control between the gas orifice and the converters. This would still further simplify the residual unit by eliminating the control tank as the reversible motor instead of operating the submergence tube in the control tank could activate the control valve direct. The proposed new units to be installed at other plants on the Los Angeles system will be so constructed.

SUMMARY AND CONCLUSIONS

The residual chlorination control as practiced on the Los Angeles water system permits a constant residual to be maintained in the treated water regardless of all variations in volume of water treated and in chlorine demand.

The need of residual control becomes evident as three minute tests throughout the twenty-four hours show that variations in chlorine demand are far greater than has been ordinarily assumed. Daily variations are as much as 25 percent above or below the monthly average dose and the hourly variations may be 40 percent of the average daily dose. By maintaining a constant residual, adequate disinfection is assured at all times, the possibility of complaints from periods of overdosing required under any scheme of manual control is eliminated and in large plants a material saving in chlorine gas used for disinfection is obtained.

RECORD CONTROL OF THE CONSTRUCTION, MAINTENANCE AND OPERATION OF A DISTRIBUTION SYSTEM

By E. W. Breitkreutz

(Assistant Engineer, Bureau of Water Works and Supply, Los Angeles, Calif.)

There is a time in the growth and development of nearly every water distribution system when those in charge of construction, maintenance and operation are faced with the realization of the importance of clear, accurate and up-to-the-minute field and office records. This realization sometimes is brought out very forcibly by an emergency, such as a serious break in a large main or trunk line, the illness or death of some old employee who has carried many important records "under his hat," or a major disaster, such as a conflagration, flood or earthquake. A striking example of the importance of records was brought out by a break in a 30-inch cast-iron main during the night, in a large eastern city in 1915. Property damage, resulting in claims totaling $150,000 took place while four hours were spent in looking for a gate. Every water works engineer or superintendent sometime or other, after seeing in the daily press an account of damages due to loss of time in a shut-off after a main break, has probably asked himself, "Can this happen in our city due to poor records?"

GATE BOOKS

Every field man, be he foreman, superintendent or other key man connected with the construction, maintenance or operation of the distribution system, should have as his most essential tool and up-to-date set of gate and circuit records. In Los Angeles, we find 12″ x 12″ loose-leaf binders with 11″ x 11″ sheets printed on one side only to be the most convenient form for these field records. The distribution system is divided into sections about one mile square at 600 feet to the inch and no street lines are shown. Lines of various types, solid, dotted, and broken up in various ways represent both streets and pipes. Each type of line represents a particular zone of supply. All

pipe lines are labeled by size and kind, except that cast-iron is not designated. Various types of fire hydrants are shown by different symbols. All gates that may require operation in connection with the distribution system are shown by numbered heavy dots. Each section carries its own series of numbers. Circuit maps are on the left, and on the right, facing the maps, is a record of each gate corresponding to the numbers shown on the map. Lines that continue to an adjoining map are terminated with an arrow and each map has marginal references to adjoining sheets, north point, scale, and at the bottom a list of symbols used. In the congested district, maps are drawn to a 300-foot scale and additional detail maps are made of intricate connections, towers, regulators and other layouts that might need clarifying. Under no circumstances, is there any duplication on different maps as this leads to chance of error. There are two indexes, one, alphabetical by streets, and the other, a small scale map showing all of the sections and the principal cross-town streets. However, men using these gate books soon learn to orient themselves quickly without index. The original map and record sheets are kept on tracing cloth. Additions and changes are accumulated in a transfer book from pipe reports and the tracings are corrected monthly.

Originally, blue line prints were corrected by hand and new prints made only when the saving warranted. At present, we find that it pays to make new sheets for even a single change. The multilith printing process is used, as it is more economical than the blue line prints and also uses a thinner paper which gives a lighter field book. Temporary blue print insertions are given to all key men within 24 hours after pressure has been turned into any new line or system. Of course, emergency night crews get this information as soon as the construction crew trucks get into the yard from the job.

There are three gate books of the entire system: One for the Engineer in charge of field operation, one for the Design Engineer's office and one in the construction office where the emergency night crews are located. Field superintendents, gate men and other key men have books that cover their field of operation. Construction foremen and leak crews are supplied with smaller district books. Construction men change books with each change of jobs. The principal books have sheets listing location of regulators, reservoirs and tanks with their main valve controls and information is added as occasion demands.

PIPE MAP

Just as the system of gate books is indispensable to the field men so is a pipe map, showing the entire distribution system, invaluable to the field office. In fact, we, here in Los Angeles, think so much of a good pipe map that the design of a new building was changed to permit vertical movement of a map through floor and ceiling. The map is attached to a back board measuring 18 feet horizontally by 12 feet vertically. This board is moved vertically by electric motor, using two 5-inch O.D. pipes with runners for guides and counterweights on the inside. The motor is controlled by a switch at the end of a horizontal hollow brass rail about waist high, extending along the front of the map for its full width. The switching arrangement is provided with automatic top and bottom stops.

The map itself is a blue line print on starched cloth and is permanently attached to the board on the top of the back side over a rounded edge. The sides are held down with adjustable metal strips. The bottom edge is weighted with lead and held against the board by a spring backed metal strip faced with felt. The scale of the map is 600 feet to the inch, about as small a scale as can be used to be workable and legible. Street lines are shown to scale and all lettering is kept off the streets. Land-marks such as parks, rivers, etc. are shown in appropriate colors, such things together with colored reservoirs being a great help in orientation on a large map.

A system of five colors; orange, green, red, brown and black is used to designate the pipe lines, reservoirs and tanks in the various zones of supply. By using dotted and solid lines of the same color for pipe lines and conduits in widely separated districts, sufficient variety is obtained to take care of the entire distribution system on the map. For example, an orange colored reservoir supplies an orange pipe system, but dotted and solid line systems originate from sources widely separated, thus avoiding possible confusion. No attempt is made to plot pipe at intersections or in the streets to scale, the idea being to show functions only. All pipe is marked as to size and kind except cast iron, which is designated only by size. All types of fire hydrants are shown in red by various symbols. All main line valves except where two serve the same purpose are indicated by black dots. Service and fire hydrant gate valves are not shown. Pipe lines over 12 inches in diameter are plotted much heavier than the smaller sized mains. High water elevations are shown on reservoirs and tanks. Coordinates are used for orientation in connection with a street name

index. Sunlight is kept off the map and strong light is filtered by the use of special window-glass. Venetian blinds are closed when the map is not in use. In spite of these precautions, the green coloring must be brightened up occasionally. Show-card colors were tried but found unsatisfactory, due to peeling off and difficulty in removing when changes were necessary. The map is kept up-to-date daily from pipe reports, subdivisions and other records.

DISTRICT SHEETS

District or atlas sheets carrying complete details of the distribution system are essential to the construction, maintenance and operation of every system, be it large or small. A scale of 100 feet to the inch is most universally used except in congested districts, where 50 feet to the inch permits more room for additional detail. Sometimes special details at 20 feet to the inch may be necessary for regulator layouts or other intricate connections. The Los Angeles system of district sheets is being revised to cover an area of about 2000 feet by 3000 feet at the 100 foot scale. Original tracings are made at the main office drafting room. Blue lines on paper are used in the field offices and kept up-to-date by draftsmen at those offices. Replacements are made due to extensive changes on the originals and wear and tear of blue lines. Mains are depicted by solid and broken lines of various kinds to indicate system elevation and are labeled for diameter, kind and class or thickness, identical with the system used in the gate books. Distances are shown from the nearest street lines and all fittings are labeled and located by indicated measurements. All gates are labeled with the size but not described or located by special measurements as the gate book should be the only authority for record of gates. Fire hydrants are shown by various symbols as in the gate books. All pipe, gates and fire hydrant data are referenced by Foreman's Pipe Location Report number and in special cases by profile or drawing number for further detail. Services are lettered in the lots served, showing measurement to nearest intersecting street, size of service and house numbers.

Each sheet has its set of symbols and a reference to gate book section numbers for gate records. The system of indexing the district map may be one of two types. For a small system a roll map may be used, with the area covered by each sheet shown with a series of water-colors and numbered appropriately with open faced type. For a city the size of Los Angeles, a system of numerical coordinates

is more flexible, especially where the index map must be of small scale to be kept within physical limits. The vertical lines are spaced 3000 feet and the horizontal 2000 feet with every fifth line made heavier and numbered only at the ends. Each district map is numbered and located according to the intersection of coordinates at its lower left hand corner. With this system of indexing, it is unnecessary to clutter up a small scale index map with a lot of sheet numbers that would really be a hindrance to orientation.

FIELD REPORTS

The method of reporting field work is a subject that should be given considerable thought. Should the reports be made by surveyors or by the foreman in charge of the work? Do you want to call out a survey party every time a structure is to be located? Or do you prefer to educate your foremen to make intelligent reports and be able to interpret records properly? In Los Angeles, foremen report all installations, removals and relocations in connection with the distribution system. Surveyors stake out lines where there is no curb or well defined property line, establish grades for trunk lines, give clearance for interfering proposed substructures, and profile all pipe lines 12 inches or over in diameter.

When a foreman begins a new job he is handed all necessary information to complete and report the job. First is the authorization, which describes the job by limits and location, gives the footage, kind, class, weight or thickness of pipe, and the permit number for street excavation. Next is a substructure sketch map of all utilities within the area of the job, then a report blank or blanks with a complete sketch of the job, showing location of pipe and fittings to be connected to but not the proposed work, and finally, a working blue-print of the job as laid out in the construction office, showing all valves, fittings, pipe and specials. The blue-print layout that went out with the authorization had been used in securing space in the street and an excavation permit.

The City Engineer is notified of any deviation from the original layout. The blue-print is also used as a temporary report for the emergency night crews and it is inserted in the principal gate books as a temporary record. The foreman uses the report blank or blanks to record the job as it actually was completed. He shows and locates all pipe, fittings, valves, fire-hydrants, intefering substructures, blocking, etc. Space is provided for reporting cover, nature of soil,

condition of filled ground, if any, jointing material used, kind of street surface and approval by a construction superintendent. Pipe is fully described, showing manufacturer, kind of material, weight, class, length of sections, diameter, thickness, type of joint, special protective coatings and any variation deviating from standard practice. Valves are recorded by make, number, and direction of turns, and distance from property and curb lines of main and intersecting streets. All pipe and valves removed, relocated, abandoned or out of commission are also listed on the report.

After the pipe reports are turned in to the construction office they are numbered, thoroughly checked by men who are in the office early enough to contact foremen on doubtful points, and the information is then posted to the district sheets, pipe map, and other records. All valve records are turned over to gate men for final checking before being posted in the gate books. If there is any question in the mind of the gate man as to the reliability of curb or property measurement on curved streets, marks are placed on curbs or pipe markers are placed at convenient locations and such marker or markers are indicated in the final gate records.

Ties to buildings, fences and other private property are to be avoided as such structures may be changed without notice. The writer remembers a gate that was located a certain distance from "Danziger's Bull Pen;" there will always be plenty of "Bull" around, but it may not always be penned up. When the country went dry a perfectly good record of a gate located from the "Cape Horn Saloon" went "haywire." Pipe reports are finally bound in book form and filed for future reference.

MISCELLANEOUS MAPS

There are several other maps which we in Los Angeles feel are necessary adjuncts in the construction, maintenance and operation of a distributing system. One is a map variously known as a skeleton, feeder main or trunk-line map, showing all mains larger than 12 inches in diameter. Another is an elevation or contour map. This map is based on the City Engineer's drainage map and kept up to date from improvement plans. U.S.G.S. sheets are secured to cover outlying unimproved territory. Each field superintendent is supplied with a small scale skeleton map showing the trunk lines and valves. The pipe lines are shown in colors similar to the office pipe map and the zones of supply are shaded in corresponding colors. We believe a

map of this kind would be a great help in case of a major disaster. The general superintendent has, in his office, a small scale map showing trunk lines in standard colors. This map shows, by the use of colored pins, various interzone connections that can be used in an emergency, all regulators, gates partly closed or temporarily shut, outages, or by-passes of a temporary nature and other points that may need watching, due to heavy rains.

GATE OPERATION AND INSPECTION

In the Los Angeles system, gates are inspected and operated periodically and on special occasions for various reasons and by different employees. Failure to keep adequate records of such inspections and operations will lead to difficulties. For convenience, trunk lines are numbered and all valves directly connected to any particular line are listed on sets of cards in order of field sequence. These cards besides showing gate section numbers and functions, are provided with a number of checking spaces. A master office record shows last date every group of trunk-line gates was inspected and operated and gives the name of employee doing the work. All other gates inspected or operated periodically and at other times when necessary are reported on special small forms. These forms are filed by gate section and gate number. By pulling out old forms as new ones come in, the files always show the last man to operate or inspect any particular gate. An operation report replaces an inspection report but the reverse does not obtain. Trunk line gates referred to above are reported on these forms at least once a year. This method of keeping record of inspection and operation of gates results in fewer broken and shut gates being covered up and helps spot careless employees. A certain group of employees is held responsible for all gates and all operation reports are turned over to these particular men for field inspection before filing.

MISCELLANEOUS RECORDS

There are a number of other records that we have found essential to distribution system records. Maps of new subdivisions, opening, widening and vacations of streets are obtained and carried through pipe maps, gate books, etc. Street name changes are obtained from legal journals. Records are kept of broken mains, inspection of regulators, altitude valves, check valves and relief valves, special tests

and inspections and all work on steel tanks. Card indexes are necessary for job authorizations and street names.

Pipe and fire-hydrant reports are indexed by street name and location. There is, in the hands of superintendents, key-men and employees on emergency watch, an alphabetical list of names, addresses and telephone numbers of employees that are subject to call for emergencies on Sundays, holidays and nights. Substructure records of other city departments and private utilities are not always reliable, so we find it advisable to have an employee familiarize himself with these organizations so that personal contact can be made in doubtful or special cases.

A multitude of complicated records are necessary therefore for the construction, maintenance and operation of a distribution system. However, the records of major importance are the Foremen's Field Reports, Gate Books, Pipe Map and the District Sheets. The paramount consideration for these records is that they be accurate, clear, and up-to-the-minute. Practically the entire distribution system being underground, errors in records may prove very costly. Just as an engineer allows a factor of safety in the design of a bridge or pipe line so, also, should distribution records have a measure of safety. Therefore, all records should be very carefully checked, in fact, in some cases, double checked. The matter of clearness cannot be too greatly stressed. Office men should keep records in such a manner as to avoid more than one interpretation by field men. Complicated records are difficult of interpretation. Avoid duplications on adjoining district sheets or gate book sections. Do not have more than one foreman make a field report of the same job. Avoid radical changes in methods of keeping records and reporting field work except for a very good reason. Records that are not right up to date lose a great deal of their value. What may happen if a foreman having just finished a job fails to report it the same day? There may be a weak pipe that might burst when static pressure is reached in the early morning hours. Someone must get the foreman out of bed to find out about the valves. In the meantime, what about property damage? Suppose field men report jobs promptly but office methods cause delays in getting the records to the gate-men and emergency crews? Isn't that just as bad as a delay in field reporting? I am sure that everyone interested in efficient distribution of water will agree with me that distribution records should be accurate, clear, and up to date.

THE MEMPHIS METER AND LEAK TESTER

By C. M. McCord

(*General Superintendent, Light and Water Division, Memphis, Tenn.*)

In Memphis, as in most cities, unaccounted for water is an appreciable item, and naturally is being given almost constant consideration. A recent check made by adding the registration of customers' meters to estimated consumption of a few unmetered connections, fails to check with our station output meters by about thirty percent. Of course, some of this loss is taking place in the mains, in services, in fire hydrants and blow-off valves. With due consideration to these various sources of leakage, it appears that a considerable amount of water is passing through meters that is not being registered. This can be due to inaccuracy of the meter and to flows which are smaller than the meter will operate on. It is generally true that in the premises of the customer, there is a twenty-four hour flow due to dripping bibbs, leakage at stop and waste cocks, flush tanks and other fixtures. The sum total of these inconsequential leaks reaches a rather surprising figure on the whole system. In Memphis, if we have an average seepage of one fourth of a pint per minute per service, this amounts to about two and a half million gallons of water per day. If we knew positively that the above surmise is actually what is taking place, our unaccounted for water problem would cease to be one of disturbing proportions. It would be a great deal of satisfaction to know just what is happening in this phase of leakage, regardless of the fact that nothing can be done about it, except to keep meters in the best practical condition.

We have seriously considered making either a partial or complete survey to determine what this leakage within the customers premises amounts to, and to determine if the meter operated on such a flow; also to check the meter for accuracy on customary flows. A survey of this kind would serve two purposes: First, it would give the amount of water that is being wasted that fails to register on the meter, and second, it would show the performance of the meters.

Our thoughts were then turned toward the practical features

of this check up. How would one determine that the customer was wasting one quarter or one half a pint per minute, or any other quantity for that matter. If the market affords an instrument or a device that can be used for this purpose, the writer was not aware of it, and therefore proceeded to make what someone has called the Memphis Meter and Leak Tester.

The measurement of this leakage must be done under the pressure that exists at the particular location. For this leakage to be visible it becomes necessary to insert in the flow a piston, or a portion of colored fluid, or a bubble of air. It appeared to be more practical to make the separation with air. The device worked out consists essentially of a small tank that serves as an air compressor, a calibrated measuring chamber graduated in one one-hundredths of a quart, flexible connections to connect to the street side and property side of the water line, a calibrated meter to which the customers' meter is compared, a means for making various flows of water pass through both the calibrated meter and the customer's meter, a tank and orifice arrangement whereby flows of one pint per minute, one quart per minute and one gallon per minute may be obtained. Other flows up to full stream can be had, but no arrangement has been made for accurately determining these flows above the gallon per minute. The one device as constructed handles five-eighths, three-quarters and one-inch meters.

The operation of the instrument for measuring the leakage within the property line and for checking the meter is as follows. The customer is notified that his meter is being checked and he is requested not to use any water for the next few minutes. The stop cock is turned off and the meter removed. Hose number one is connected to the street side meter coupling, and hose number two to the property side meter coupling. Valves 3, 13, and 6 are closed and water turned on at the stop cock. Valve 4 is now opened and water service is re-established to the premises. Valve 6 is now opened slowly, allowing measuring chamber 22 to fill to the top of the glass. The valve is then closed. The scale, divided into one one-hundredths of a quart, is adjusted so that it will be slightly below the water level in the glass. Valve 14 is closed and 13 is opened which permits water to flow into tank 23 and compresses the entrapped air to water main pressure. This air is piped from the top of the tank to the top of the measuring chamber through line number 10. Valve 4 is now closed and valve 6 opened. The property line

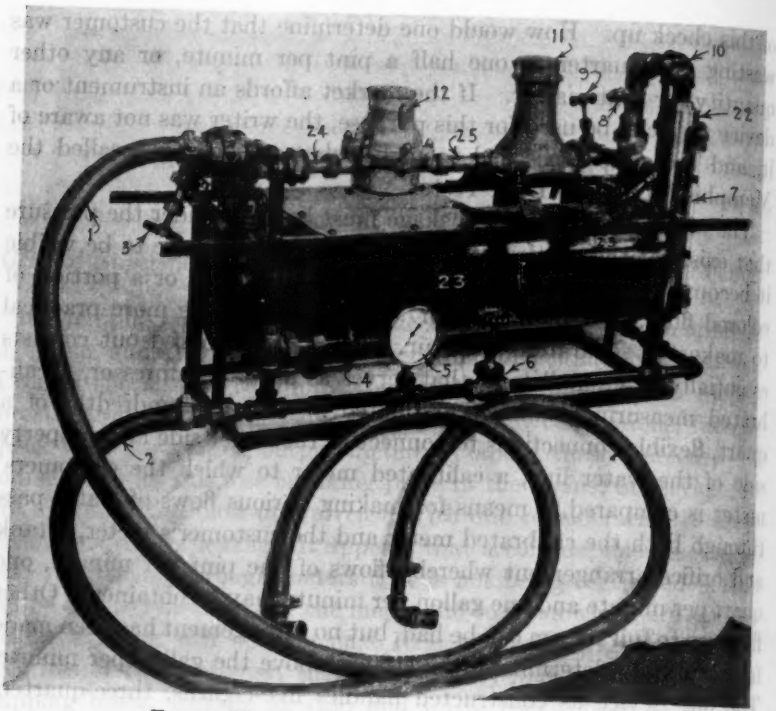

FIG. 1. MEMPHIS LEAK AND METER TESTER

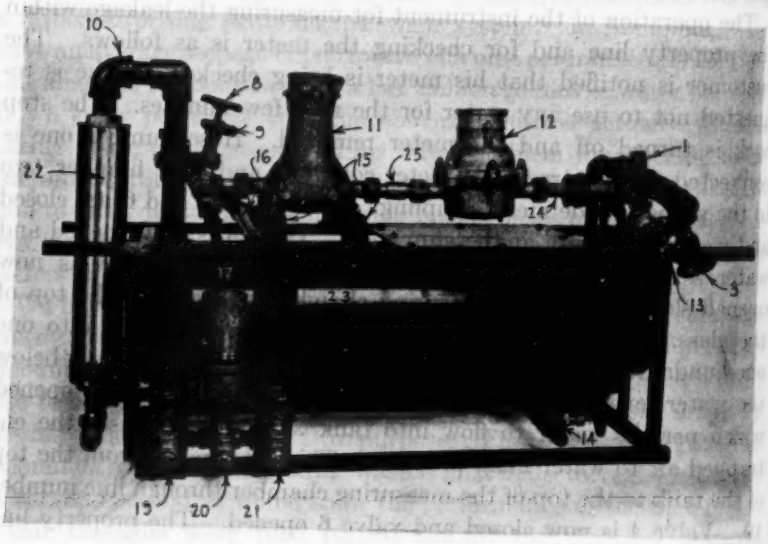

FIG. 2. MEMPHIS LEAK AND METER TESTER

is now being supplied by water from chamber 22. As the water drops down in the glass, on reaching the zero point of the scale the operator releases a stop watch. If the leakage is slow, it can be timed for a full minute or more. If the leakage is large it must necessarily be timed for a fraction of a minute. While this reading is being taken, gauge 5 is read as a record of water pressure at this particular location. The scale reading multiplied by three and six-tenths and by the reciprocal of the fraction of a minute timed or minutes timed, converts the leakage into gallons per twenty-four hours.

After this reading has been obtained, valve 13 is closed, valve 6 closed, valve 4 is opened, restoring water to the premises, and valve 14 opened to drain the tank. The meter removed from this particular location is placed in position as shown at 12. Valve 3 permits water to flow through both meters. By closing valve 8 and adjusting needle valve 9 so that reservoir 18 is full when water is flowing from orifice 19, the meter is checked for movement at one pint per minute. By using orifice 20 it can be checked at one quart per minute. Orifice 21 flows one gallon per minute. By closing valve 9 and operating valve 8, other flows are obtainable up to full stream.

EXPERIENCE WITH CEMENT WATER MAIN JOINTING MATERIALS

By Frank M. Murphy

(*Superintendent of Distribution, Water Works, El Paso, Tex.*)

The joining of lengths of pipe together so as to form a continuous channel for the distribution of liquids or air under pressure has been a problem since man first started to carry, under control, these substances from one place to another.

In olden days, the hollowed out log was joined together with a sleeve of wood of larger diameter. The ends of the pipe were tempered and driven into the sleeve. Pipe made of lead also dates back to ancient history, and was made continuous by burning or fusing the metal itself.

In modern times, pipe made of steel, cast iron, brass, copper, cement, asbestos and wood have been joined together with every imaginable type of joint.

Many times the failure of a pipe line, although constructed of excellent material, has been caused by a poorly designed joint, or by the use of an inferior material making the joint.

The engineer who designs a water system should take many things into consideration, such as climatic conditions, depth of line, wet or dry trenches, temperature of water, amount of traffic, pressure to be carried, and maybe others, before he specifies his jointing materials.

Here, in the West and South, very little attention need be given to frost and severe weather. A 30- to a 36-inch cover, as a rule, will be sufficient, while localities that have colder weather to contend with might require a cover of twice this depth.

The deep trench has its advantages and disadvantages. The first cost is, of course, greater. A leaky joint, or pipe, is more difficult to locate and repair, while, on the other hand, expansion and contraction are minimized and traffic jar is lessened.

Wet trenches are another source of trouble, causing conditions that tend to destroy bolt and thread type of joints, and also, causing some of the compounds used in joint making to soften and fail.

Considerable trouble from joint leakage has developed in localities where the water from wells enters the distribution or pump line hot.

As a rule, the amount of money available for a project is limited and sometimes inadequate. Therefore, in order to get as much for the money as possible, the substitutes are paraded before the authorities as the answer to all their prayers. My suggestion on substitution is that every effort should be made to prove the claims made for the substitute, before adopting it, even to giving it a rigid and severe test.

The breakdown test on materials and appliances will save many times the cost and at times, the success of the very job itself. Many manufacturers frown on this method, but I believe it is good business for the water department, as a valve, meter, pipe or appliance cannot be judged by its looks, as practically all of them work while they are new.

As this round table discussion today deals with a joint making material that many of you present may never have used, but which is gaining new converts rapidly, let us put it in the substitute class and see if it has any value.

It is my understanding that the Los Angeles Water Department has developed this type of joint to the point where it is no longer an experiment. If this be true, we should be able to get some real information from this discussion. My own experience with its use has convinced me that it has a place in the water works field. For those who wish to try this material, the methods used by the El Paso Water Department as outlined below may be helpful:

TOOLS NECESSARY

1 wheelbarrow, 1 light hoe, 1 3-lb. Mueller caulking hammer, 1 yarning iron, 1 set of caulking irons with bits curved to fit curve of pipe. (Bits to be 3″ x $\frac{3}{16}$″, 3″ x $\frac{1}{4}$″, and 3″ x $\frac{3}{8}$″, and wider if necessary.)

Use two coils of dry jute, pipe centered and jute well driven.

CEMENT TO BE USED

Regular Portland Cement. Use no sand or gravel. Put 25 pounds of cement in wheelbarrow, sprinkle lightly with water, mixing well with hoe. Use only enough water to dampen cement. It must not be wet. Open up a sack for a carrier. Let your calker take enough cement for a couple of joints. Put this cement carrier under the joint to be made and all spilled material will be saved.

Calker starts at bottom, filling with one hand and tamping with

other until he has completed a round of the joint. Then take 3-pound hammer and calk up tight. Repeat this operation until joint is full. Finish flush. It is unnecessary to heap any material outside the joint.

A finish is made with the pointer finger.

The joint will be ready to stand any pressure in twenty-four hours. A little longer is better.

If this joint sweats, do not worry. It will take up about the same as other joint making compounds.

The cost of material and labor required for making these joints of sizes from 4 to 20 inches will give you a comparison with the cost of other types of joint.

In the following set-up no allowance has been made for wastage, which is very small if care is used in mixing and handling the cement.

SIZE	AVERAGE TIME AT 60¢ PER HOUR	JUTE REQUIRED AT 24¢ LB.	CEMENT AT 65¢ SACK	COST PER JOINT
inches	*minutes*	*ounces*	*pounds*	*cents*
4	8	3	2	13.9
6	9	4	2	17.1
8	10	5½	4	21.0
10	11	7½	5	25.7
12	14	8¼	6	30.5
14	20	9	7	38.4
16	25	10	8	45.6
20	30	12	10	55.0

Braided jute, that is jute free of all oil, is used, and it is our practice to use two coils to each joint. The ½-inch square jute will properly space nearly every size joint, although when ordering, a bale of ⅝ size and one of ¾ size are included in each ton to take care of special or irregular joints. Some users of cement joints have discontinued the use of jute, claiming that its use was not necessary for the success of the joint. While it is true that a joint apparently just as good can be made without jute, it is my belief that when the jute is left out, the rigidity of the joint is considerably increased. Should it become necessary also to salvage or move a line, the cement is more difficult to remove. A joint that is completely filled with any jointing material is more difficult to remove than one that has jute or packing below the harder material.

We also find that joints made without jute have considerable more leakage during the test and take longer time to become tight.

Tests have been made for leakage on the completion of each job

where cement joints were used, and the results obtained were so good that all the mechanics and foremen who were skeptical at first are now sold on the joint.

One particular line of 20-inch crossed a railroad yard with 42 track crossings. This line was laid 4 feet below the ties and we were required to complete 60 feet each day, leaving a covered ditch, so that lights would not be necessary during the night. A valve was set on each side of the yard, 1100 feet apart. After the line was completed, an official test was made for the representatives of the railroad company. At the start of the test, it was shown that the leakage, under 80 pounds pressure, was 3 gallons per minute. At the end of 24 hours, this amount had reduced to 1½ gallons per minute, and at the end of 48 hours, the leakage on the 1100 feet of line was one quart per minute.

At the end of 2½ years, another test was made and the line was found to be absolutely tight.

BELL HOLES

The space required for a bell hole is the same as that required for lead substitutes. Any joint that has sufficient room for proper yarning is satisfactory for the making of a cement joint.

NON-CONDUCTOR

What is going to be the result of this joint, which is a non-conductor, on our electrolysis troubles? Will it aggravate them, or will it put the load over on some other utility?

THE SECOND REPORT OF THE COMMITTEE ON CHEMICAL HAZARDS IN WATER WORKS PLANTS[1]

Ammonia

Your Committee on Chemical Hazards in Water Works Plants begs to report as follows: This is the second report of this committee; the first being submitted at the time of the 1935 A. W. W. A. convention in Cincinnati. The first report presented data and first aid suggestions on chlorine, the chemical most generally used in water works plants. (Journal, September 1935, page 1225.)

Because of the favorable comments and acceptance of the first report, your committee has prepared a similar report on ammonia, which is herewith presented for your approval.

At present there is only a limited use in water works plants of relatively dangerous chemicals other than chlorine and ammonia, and the chemicals other than chlorine and ammonia that are more generally used produce no serious hazards. For these reasons your committee recommends that no additional reports of the nature of this report be prepared. Further, your committee deems it not advisable for this committee to conduct experiments and studies seeking improved physical means of transporting, storing and utilizing chlorine and ammonia. Consequently, your committee is of the opinion that the real purpose of its formation has been accomplished and therefore asks that it be discharged.[2]

We are again indebted to Mr. L. L. Hedgepeth of the Pennsylvania Salt Manufacturing Company and Mr. H. H. Gerstein, Department of Public Works, Chicago, committee members, for special work in the first and second parts of this report, respectively. The committee also wishes to thank Mr. Edmond Rowland of the Henry Bower

[1] Printed as a tentative recommendation upon the authorization of the Water Works Practice Committee. Criticism and discussion are invited by the Committee prior to final adoption of the report.

[2] The Water Works Practice Committee has taken this request for discharge under advisement, since it is not yet convinced that the excellent work of the Committee is complete.—*Malcolm Pirnie, Chairman, Water Works Practice Committee.*

Chemical Manufacturing Company for his valued assistance and the ammonia manufacturers who have constructively criticized parts of this report.

L. H. ENSLOW
GEO. H. FENKELL
H. H. GERSTEIN
A. E. GORMAN
R. F. GOUDY
FRANK E. HALE
L. L. HEDGEPETH
NORMAN HOWARD
H. S. HUTTON
W. C. LAWRENCE
W. S. MAHLIE
M. C. SMITH, *Chairman*

AMMONIA

While no fatal or serious accidents caused by the utilization of anhydrous ammonia in water plants are known to your committee; yet, it is a compound possessing potential dangers due to its inherent chemical and physical characteristics and to the fact that it is marketed in containers under pressure. The object of this report is to reiterate those properties of anhydrous ammonia which are of concern to water works operators and to outline approved methods of handling and storing.

GENERAL CHARACTERISTICS

Ammonia is a chemical compound composed of 1 part nitrogen and 3 parts hydrogen by volume, or 82.25 percent nitrogen and 17.75 percent hydrogen by weight. Its formula is NH_3, molecular weight 17.032, melting point $-107.9°$ Fahr., boiling point $-28°$ Fahr., critical temperature 271.4° Fahr., critical pressure 1657 pounds per square inch absolute. Anhydrous ammonia is a colorless liquid which, at 70° Fahr., is 0.61 times as heavy as water, weighing 38.0 pounds per cubic foot.

Liquid ammonia volatilizes to a colorless gas of penetrating odor which is 0.597 times as heavy as air at standard conditions, weighing 0.0482 pounds per cubic foot. Neither gaseous nor liquid ammonia is inflammable under normal conditions, but mixtures of air and ammonia, containing from 16 to 25 percent NH_3 by volume, may

explode when sparked or exposed to temperatures exceeding 1200° Fahr. Prolonged contact of ammonia with mercury also constitutes an explosion hazard.

Dry ammonia is not corrosive to the common metals, but moist ammonia attacks copper and all of its alloys. Liquid ammonia is a comprehensive solvent dissolving many non-metals, inorganic salts and organic compounds.

PHYSICAL CHARACTERISTICS

The vapor pressure of anhydrous ammonia is depicted in figure 1. Ammonia confined in a container may exist as a gas, liquid, or both. For all conditions of temperature and pressure whose values meet on this curve, the gas and liquid are in a state of equilibrium.

If these values meet *above* the curve, the liquid is boiling into a gas; if they meet *below* the curve, the gas is condensing into a liquid. This curve, of course, does not apply if the container is entirely filled with liquid.

Figure 2 shows the density of liquid ammonia at various temperatures and figure 3 indicates the effects of this varying density on any container filled to the legal limit. This limit, at present, permits a quantity of ammonia equal to 54 percent of the water capacity of the container. Obviously such a container is completely full of liquid at 145° Fahr. and higher temperatures would be liable to rupture the container.

Ammonia is very soluble in water. At 32° Fahr. 1150 volumes of ammonia will dissolve in 1 volume of water or 47.3 percent by weight. Figure 4 illustrates the percent solubility of ammonia in water at various temperatures. The practical advantages of this characteristic of ammonia are observed in the employment of dry feed ammoniators and the utilization of showers for controlling serious leaks.

GASSING RATES

We are indebted to the Wallace and Tiernan Company, Inc. for furnishing and installing the ammoniator, the Henry Bower Chemical Manufacturing Company for furnishing the horizontal containers and ammonia, and to the Pennsylvania Salt Manufacturing Company for furnishing space, staff, and materials to conduct special studies to determine the maximum gassing rates of standard containers.

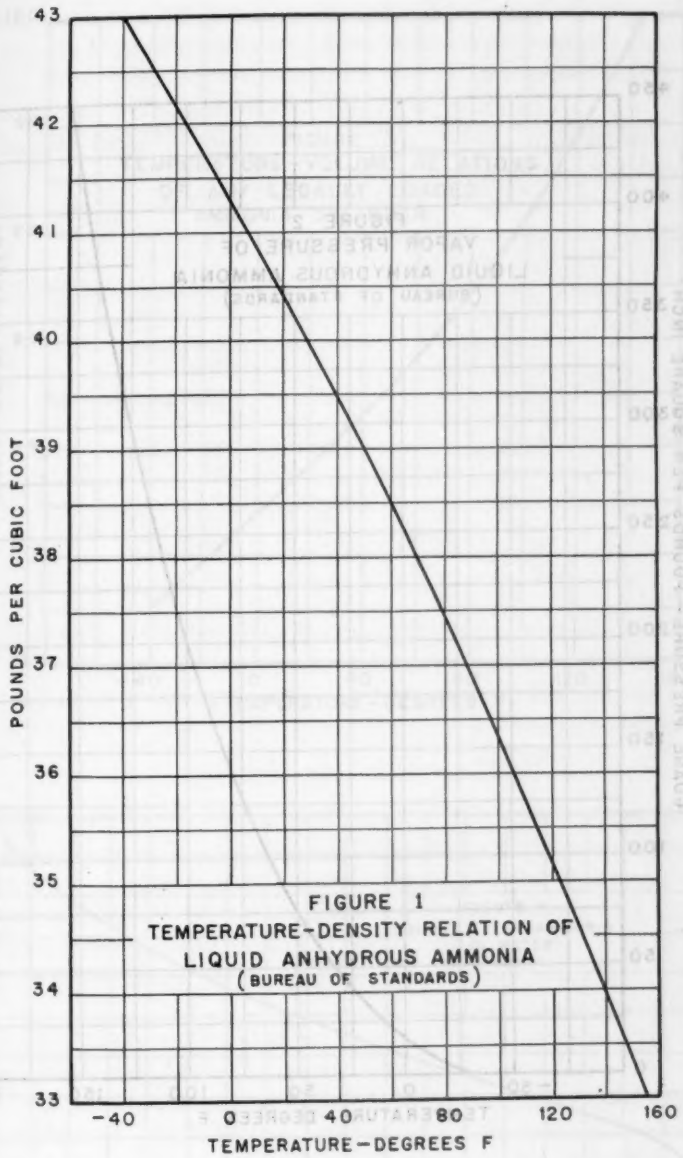

FIGURE 1
TEMPERATURE-DENSITY RELATION OF LIQUID ANHYDROUS AMMONIA
(BUREAU OF STANDARDS)

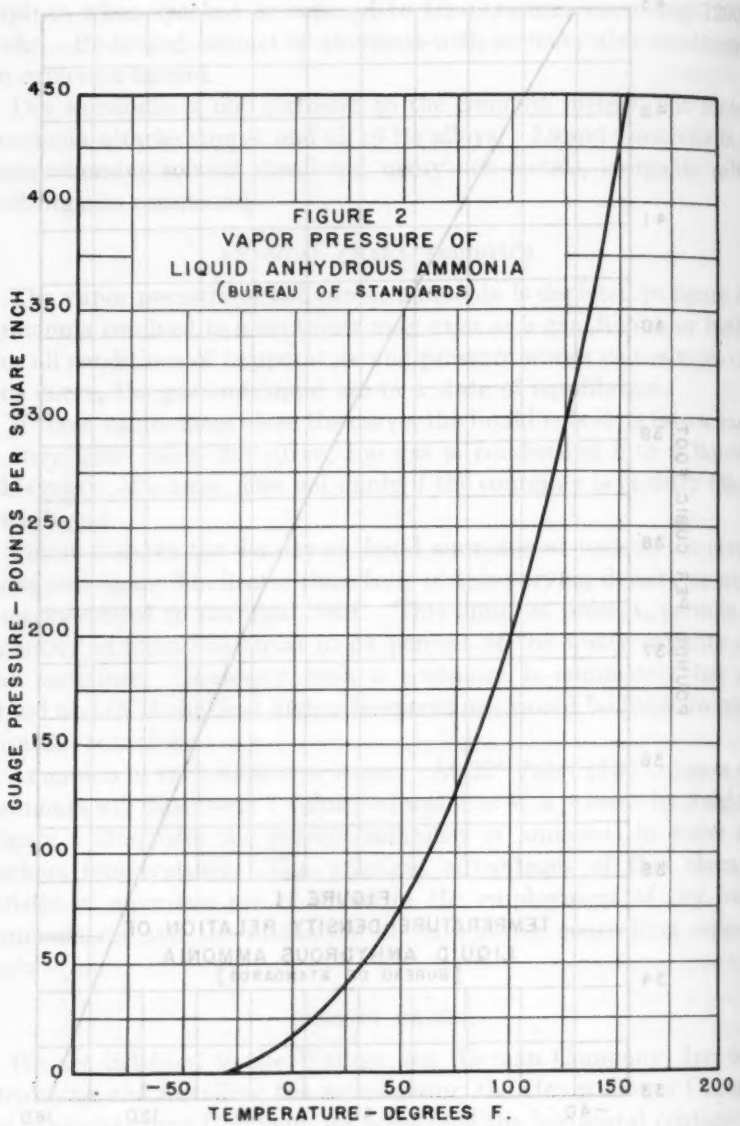
FIGURE 2
VAPOR PRESSURE OF
LIQUID ANHYDROUS AMMONIA
(BUREAU OF STANDARDS)
GUAGE PRESSURE – POUNDS PER SQUARE INCH
450
400
350
300
250
200
150
100
50
0
–50
0
50
100
150
200
TEMPERATURE – DEGREES F.

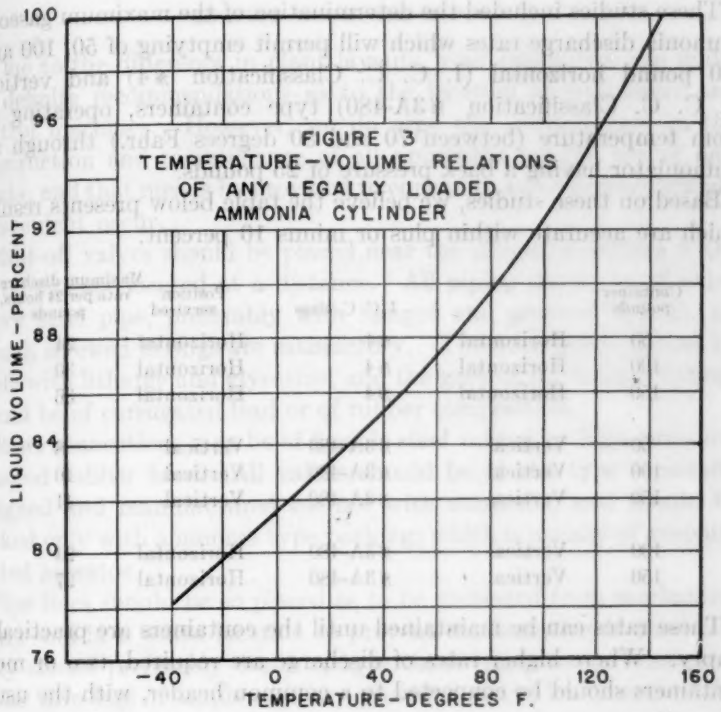

FIGURE 3
TEMPERATURE—VOLUME RELATIONS
OF ANY LEGALLY LOADED
AMMONIA CYLINDER

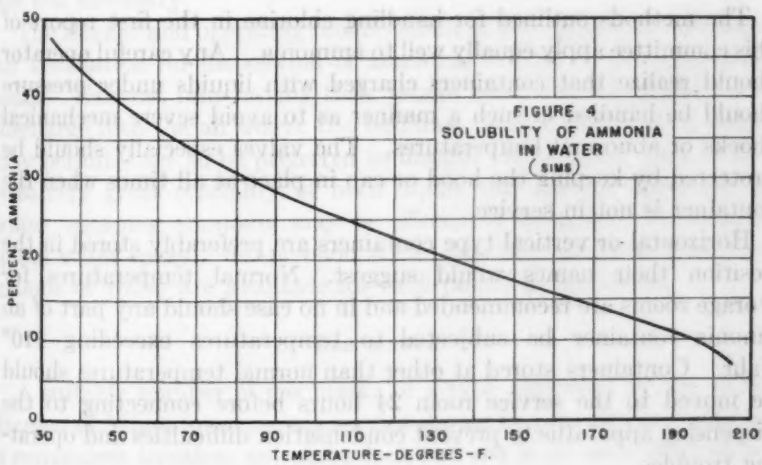

FIGURE 4
SOLUBILITY OF AMMONIA
IN WATER
(SIMS)

These studies included the determination of the maximum gaseous ammonia discharge rates which will permit emptying of 50, 100 and 150 pound horizontal (I. C. C. Classification #4) and vertical (I. C. C. Classification #3A-480) type containers, operating at room temperature (between 70 and 80 degrees Fahr.) through an ammoniator having a back pressure of 25 pounds.

Based on these studies, we believe the table below presents results which are accurate within plus or minus 10 percent.

Container pounds		I. C. C. class	Position serviced	Maximum discharge rate per 24 hours, pounds
50	Horizontal	#4	Horizontal	24
100	Horizontal	#4	Horizontal	30
150	Horizontal	#4	Horizontal	36
50	Vertical	#3A-480	Vertical	8
100	Vertical	#3A-480	Vertical	10
150	Vertical	#3A-480	Vertical	11
100	Vertical	#3A-480	Horizontal	24
150	Vertical	#3A-480	Horizontal	27

These rates can be maintained until the containers are practically empty. Where higher rates of discharge are required, two or more containers should be connected to a common header, with the usual precautions.

HANDLING AND STORING

The methods outlined for handling chlorine in the first report of this committee apply equally well to ammonia. Any careful operator should realize that containers charged with liquids under pressure should be handled in such a manner as to avoid severe mechanical shocks or abnormal temperatures. The valves especially should be protected by keeping the hood or cap in place at all times when the container is not in service.

Horizontal or vertical type containers are preferably stored in the position their names would suggest. Normal temperatures for storage rooms are recommended and in no case should any part of an amonia container be subjected to temperatures exceeding 110° Fahr. Containers stored at other than normal temperatures should be moved to the service room 24 hours before connecting to the dispensing apparatus to prevent condensation difficulties and operating troubles.

SERVICE ROOM AND PIPING

Due to the difference in plant layouts, your committee can make no definite recommendations as to the location of containers and control machines. However, we do urge the greatest care in the construction and maintenance of all apparatus for the use of ammonia, and that means be provided to cope with an emergency should an accident occur.

Shut-off valves should be placed near the control machines if the containers are located at a distance. All piping should be of extra heavy steel pipe, preferably with flanged and grooved fittings, although screwed fittings are satisfactory. Threaded joints should be made with litharge and glycerine; and the gaskets for flanged fittings should be of corrugated lead or of rubber composition.

Short connections may be of flexible steel tubing or high pressure, armored rubber hose. All valves should be of the type especially designed and manufactured for use with ammonia, and should be packed only with ammonia type packing; which is usually of graphite coated asbestos.

Pipe lines should be so placed as to be protected from mechanical injury and in a warm location to prevent condensation in the lines. They should preferably drain back, without traps, to the container, or else drip legs of ample capacity provided at the low points of the line. Of course, where temperature or pressure conditions are such that condensation cannot occur (see figure 1), the above precautions are not necessary.

The storage and operating rooms should be provided with adequate air ventilation for disposition of ammonia in case of uncontrollable leaks. Exhaust fans having their intake near the ceiling and their discharge into the air above the building, (where surrounding property permits) are to be preferred to normal ventilation. Due to the relatively great solubility of both liquid and gaseous ammonia in water, escaping ammonia may be effectively dissipated by an adequate water spray. Submersion is also practical where at least two gallons of water are available for each pound of ammonia.

GAS MASKS

A suitable number of gas masks of a type approved by the U. S. Bureau of Mines for ammonia service should be provided and kept in a convenient location, not under lock and not in an area likely to be

heavily affected. Operators should be instructed that whenever gas masks are needed, an assistant should always stand by with his mask ready to assist if needed.

Routine inspection of the masks and the operators' ability to use them should be made every three months. The manufacturer should advise the proper maintenance and spare canisters should be available at all times.

When more than one hazardous gas is used in the plant, it may be preferable to use canisters that will serve in an emergency due to any of these gases.

For ammonia, where it is impossible to obtain a mask, a wet cloth over the nose and mouth may lessen the danger of exposure.

Loose-fitting, thick, non-porous gloves and aprons should be kept with the masks, to protect the wearer from liquid ammonia.

GENERAL RECOMMENDATIONS

1. An understanding of the characteristics of ammonia will reduce general operating difficulties.

2. Remember that ammonia containers are under pressure and should not be subjected to rough handling.

3. Avoid subnormal and abnormal temperatures and never expose a container to temperatures exceeding 110° Fahr.

4. Never mix gaseous or liquid ammonia with other gases or liquids—a violent chemical reaction may result.

5. In case of leaks remember that ammonia is lighter than air and rises, and that it is very soluble in water.

6. Use none but ammonia valves, packing and gauges for ammonia service.

7. Follow the manufacturer's directions for handling and utilizing ammonia.

8. Notify the manufacturer of any defect in the container or valve before returning the container.

9. Stop leaks as soon as detected. Locate small leaks by the white vapor produced when either a bottle of hydrochloric acid or a burning sulphur taper is held near the leak.

10. Large leaks are dangerous; masks and protective clothing should be worn and the emergency equipment started in every such case.

11. One volume of liquid ammonia is the approximate equivalent of 823 volumes of gas, hence try to move container so the gas not liquid escapes.

12. Cooling the container reduces the pressure.
13. Liquid ammonia will produce serious skin burns.

"FIRST AID" TREATMENTS FOR VICTIMS OF AMMONIA GASSING

This committee wishes to impress upon everyone interested that the following "first aid" suggestions are made fully realizing their limitations. We are not attempting to practice medicine and are no more than suggesting what many believe to be the most effective aid that may be rendered the victim until a trained physician can be obtained.

The action of ammonia gas on the human system is principally the irritation of the mucous membrane and moist surface tissues, particularly those of the upper respiratory tract, the conjunctiva of the eyes and the skin. In some cases the inhalation of large amounts of ammonia may cause sudden death from spasm or inflammation of the larynx. High concentration of the gas will cause tearing and irritation of the eyes, and may produce permanent damage if immediate remedial measures are not taken.

Liquid ammonia may cause severe injury to the skin, due to the rapidity with which it evaporates, freezing tissues at the point of of contact, and due to its caustic action. The symptoms of ammonia burns are practically the same as those of thermal burns. Approximately 2 percent of ammonia is the maximum strength which the human skin will endure. Greater concentrations have an intense irritating action on the tender parts of the body subject to perspiration, the effect increasing with the concentration.

Following are physiological responses to various concentrations of ammonia taken from technical paper No. 248 of the Bureau of Mines:

Physiological response to various concentrations of ammonia

Effect	Parts of NH_3 per million parts of air
Least detectable odor	53
Least amount causing immediate irritation of eye	698
Least amount causing immediate irritation of the throat	408
Least amount causing coughing	1720
Maximum concentration allowable for short exposure (½ to 1 hour)	300 to 500
Dangerous for even short exposure (½ hour)	2500 to 4500
Rapidly fatal for short exposure	5000 to 10000

Discussion of treatments

In Appendix "A" are listed the principal sources of information for this section of the report, of which acknowledgment is made.

In general, the treatment recommended for ammonia gassing is very similar to that for chlorine gassing, since the action of the gases upon the human system is practically the same. It is to be regretted that very little was found in the literature regarding treatment of severe cases of ammonia gassing.

In the treatment of ammonia skin burns most of the references recommend immediate dilution of the irritating chemical by washing with large amounts of water followed by treatment similar to that for thermal burns which consists of application of carron oil (mixture of one part linseed oil and one part of lime water) or picric acid to the burned area.

The most recent publication giving instructions for "first aid" treatment of ammonia burns, that issued by the Pennsylvania Salt company, warns against the use of oils or phenol derivatives such as picric acid on deep or extensive burns.

It was found that there has been a radical change in the last year or so in the method of treating burns, particularly in that the use of picric acid and oils to cover the burned areas is contraindicated. A new method of treatment which was developed by Dr. Edward C. Davidson of the Henry Ford Hospital of Detroit, consists of the application of a 5 percent solution of tannic acid to the burned area. This treatment was adopted with marked success about a year ago by the Rescue Squads of the Chicago Fire Department, and is rapidly being introduced throughout the country for "first aid" treatments and hospital practice. Therefore, it is deemed wise to recommend the tannic acid treatment, even though none of the sources of information regarding "first aid" treatment of the skin burns mention this treatment. It is believed that this omission is due to the fact that the treatment is so recent that information regarding it has not yet been made available to those sources.

Recommended "first aid" instructions

The following "first aid" measures are recommended to be taken *pending the arrival of a physician* who should then take charge of the patient.

1. Remove the person affected *at once* to an atmosphere free of ammonia fumes. Have patient lie flat on back in a relaxed posi-

tion. Keep patient quiet and warm, preventing chilling by wrapping in blankets and using hot water bottles if necessary. Guard against exposure to drafts, especially if patient is perspiring freely. *Do not excite or exercise the patient unduly.*

2. Call physician.

3. If patient is unconscious, immediately start using prone pressure method of producing artificial respiration. If available, call fire department rescue squad but be sure that they do not use a pulmotor or other mechanical means of resuscitation because of the danger of rupturing the lungs of the patient.

4. If the patient is conscious, encourage the drinking of large amounts of water.

Nose and Throat Burns

5. Allow patient to snuff boric acid solution up nasal passages. Rinse mouth and gargle throat with solution.

Skin Burns

6. Strip ammonia saturated clothing from body and wash burned area freely with water for the purpose of diluting the caustic. Moisten sterile dressing in a freshly made up five percent solution of tannic acid in sterile water and apply to the burned area. Keep the dressing moist with the tannic acid solution until the burned area attains a dark brown color. Do not allow the tannic acid solution to come in contact with the inner surfaces of the eyes as harmful results may follow.

Eye Irritation or Burns

7. Lift eyelids and pour 2 percent boric acid solution over eyeball or bathe with large amounts of running water from faucet or bubbler fountain. When eyes are thoroughly flushed (5 minutes) allow two drops of liquid petrolatum to fall on each eyeball.

First Aid Supplies

2 ounces tannic acid powder U. S. P. fluffy
2 pint jars of boiled water
1 quart of 2 percent boric acid solution
1 package sterile gauze
1 bottle liquid petrolatum and medicine dropper

The 5 percent tannic acid solution should be freshly prepared by dissolving eight (8) level tablespoons of the tannic acid powder in a glassful of boiled water.

In emergencies, in case tannic acid powder is not available, a solution may be prepared by boiling four to eight teaspoonfuls of dry tea leaves in one cup of water for three to five minutes. Cool to body temperature and use solution as directed above.

APPENDIX "A"

SOURCES OF INFORMATION—EFFECTS OF AMMONIA GASSING AND "FIRST AID" TREATMENT

1. "Noxious Gases." Yandell Henderson and Howard W. Haggard, Chemical Monograph No. 35, Chemical Catalog Co., 1927.
2. Technical Paper No. 248, 1921, Bureau of Mines, Dept. of Interior.
3. "The Medical Aspects of Chemical Warfare." Edward B. Vedder, Lieut. Col. M.C. U.S.A., Williams & Wilkins, 1925.
4. "Industrial Health." G. M. Kober and E. R. Hayhurst, P. Blakeston's Son & Co., 1924.
5. "Toxicology." Frank P. Underhill, P. Blakinston's Son & Co., 1928.
6. Occupation and Health Bulletin No. 41, International Labour Office, 1926.
7. National Safety Council Safe Practice Pamphlet #61, "Mechanical Refrigeration."
8. Pamphlet "Useful Information on Anhydrous and Aqua Ammonia" Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., 1935.
9. "Handling and Storing Water Works Chemicals." L. L. Hedgepeth, Journal Southeastern Section, A. W. W. A., 1934.
10. Pamphlet "Ammonia for Refrigeration," Merrimac Chemical Co., Boston, Mass.
11. Pamphlet "Anhydrous and Aqua Ammonia," National Ammonia Co., Philadelphia, Pa.
12. Correspondence—H. H. Meyers, Technical Service Bureau, Barrett Co., New York City.
13. Correspondence—Walter L. Savell, Technical Advisor, Mathieson Alkali Works, New York City.

14. Correspondence—B. E. Seamon, Westland Engineering Supply Co., Chicago, Illinois.
15. "Tannic Acid Treatment for Burns for Fire Departments." Harry H. Wolff, Chicago Fire Department.
16. "Tannic Acid for Burns." Dr. H. P. Sullivan, National Safety News, June 1935.
17. "First Aid Treatment of Burns." Dr. J. J. Wittmer, National Safety News, January 1936.

PUMPING STATIONS ON THE COLORADO RIVER AQUEDUCT

By M. Spillmann

(Chief Engineer, Worthington Pump and Machinery Corporation, Los Angeles, Calif.)

In speaking about the pumping plants of the Colorado River Aqueduct it is necessary to consider at first the conditions under which the equipment will be operated.

We are faced with the problem of pumping large quantities of water (600 cubic feet per second for the initial installation and 1600 cubic feet per second when completed) over a difference in elevation of approximately 1360 feet, while an additional lift of about 300 feet is due to the resistance in pipes and channels. Since the differences in elevation are distributed over a long range five separate pumping plants will be used in series with several reservoirs of different capacities in between them. The initial power consumption of all pumping plants combined will be approximately 100,000 kw., while the final capacity requires approximately 280,000 kw.

Since the water will be used largely for domestic water supply the utmost reliability in every detail of the pumping equipment is imperative. The surface form of the terrain calls for two stations with approximately 440 feet pump lift, two stations for approximately 300 feet pump lift, and one station for approximately 150 feet pump lift. It is clear therefore, that especially for the high and medium head pumps the greatest care had to be exercised in developing the mechanical features of the pumping equipment. The large power consumption on the other hand made the efficiency of the pumps a feature of foremost importance. It merely has to be remembered that for the final installation the difference in efficiency of 1 percent on all pumps would correspond to a gain or loss of $40,000 per year in power costs.

The greatest mechanical reliability, as well as high efficiency prompted the adoption of a vertical shaft arrangement for pumps and motors. One of the principal advantages of this arrangement

lies in the possibility of placing the pumps low enough to obtain a positive head on the inlet side. Only with this arrangement could one hope to overcome even the highest pump lifts (440 feet) in one stage without running into the danger of cavitation. However, the final answer to the question whether a single or two stage arrangement can be used in these plants required still further investigations. For this and other reasons, which shall be discussed later, the Metropolitan Water District has developed a special pump laboratory located on the campus of the California Institute of Technology in Pasadena. The pump engineer who has visited and seen this laboratory in operation must admit that it represents an almost revolutionary advance beyond standard pump testing practice. This is easy to understand for two different reasons. Firstly—the District and the staff of the California Institute of Technology could concentrate their efforts on the solution of a limited group of specific problems. In particular the pumps which had to be investigated covered but a relatively small field of speed, head and other operating conditions. Secondly—it was clear from the beginning that due to the tremendous importance of the efficiency of the final equipment considerable time, effort and money could be spent in order to obtain the greatest accuracy. It must be said that in view of well known practical difficulties the initial goal of obtaining an accuracy of 0.1 percent for the efficiency results on the test pumps appeared to be almost too ambitious to permit a practically useful realization. Later results, however, have actually demonstrated that this goal has been reached, an achievement for which members of the staff of the Laboratory must heartily be congratulated.

CONTROLLING CONDITIONS

It would lead too far to enter into any details of the scrupulous and pains-taking work which has been done in this laboratory. It may suffice to point out some of the results which had direct influence on the development of the pumping equipment for the Aqueduct:

Firstly: It was found that the pumping head per stage could readily be increased to 440 feet or more without any sacrifice in efficiency, provided a corresponding inlet head is available. The single stage arrangement for all plants naturally leads to a much cleaner and simpler arrangement of the pumping equipment than would have been possible with a two stage arrangement. Furthermore it was found that single suction pumps could be used successfully, allowing

an arrangement whose mechanical advantages can be considered as well established through the experience with numerous water power installations. In order fully to appreciate the influence of these results on the final form of the pumping plants we compare the first layout for a typical high head plant as published in the "Preliminary Surveys, Designs and Estimates" of the Metropolitan Water District of Southern California with the present layout. The first layout shows two double suction, vertical shaft pumps in series, driven by two separate motors. The present single stage arrangement in comparison, is, of course, simpler, more compact and especially less expensive. Also the mechanical arrangement of the individual pumps is simpler for single than for double inlet considering the high pressure which the pump casings have to withstand. This will become still more apparent when we shall turn to the mechanical details of the present high head pumps.

Another most important contribution of the laboratory lies in the fact that for the first time the shaft deflections due to unbalanced radial forces acting on the pump runner in an open volute casing were actually measured with the pump in operation and promising attempts have been made to explain the origin of these forces. In this connection, as well as in many other respects, the investigations of Dr. R. C. Binder under the direction of Dr. R. T. Knapp are likely to become of great importance. These investigations deal with the measurement of flow conditions in the volute casing of pumps of high efficiencies so that the results ultimately will be directly applicable to the problems of the practical pump designer.

Finally we must not forget the experimental investigations concerning transient phenomena in large pumping plants which occur during starting and in particular during a sudden shutdown of one pump, or the whole plant. If we consider for instance a sudden interruption of the power supply to the pumps, it is clear that the water will begin to rush backwards through the pumps as soon as the kinetic energy of the rotating masses as well as of the moving water column in the penstock has been spent. The question arises whether such a phenomenon could have any disastrous effects, in particular whether the pressure in the pump and conduits might temporarily reach dangerously high values and whether the speed of the pump when working as a turbine under the influence of the returning water might become exceedingly high. It is clear that the interaction between the pump characteristics under such abnormal conditions

and the changes in kinetic energy of the moving masses as well as the so-called water hammer phenomena are of greatest importance, and there can be no doubt that the results of the laboratory concerning this matter will materially contribute towards the safety and reliability of the operation of the Metropolitan Aqueduct.

With a laboratory with such qualities on hand it was but natural that the District and the contracting pump companies are making full use of the possibility of precise model studies regarding the pumps which will have to be installed. It is to be expected that the accuracy of these model experiments will help a great deal in obtaining satisfactory operation of the large pumps as far as their hydraulic features are concerned. It has been pointed out, however, that the latter do not represent the whole extent of our problem.

In discussing the mechanical features of the pump we must first call attention to the fact that, according to present experience, the highest efficiency of centrifugal pumps is obtained by using volute casings without guide vanes. Hence a radial section through a pump casing in general will have the shape of a horseshoe open towards the center of the pump with the covers attached to the two ends of the horseshoe section. This form, which may be called the standard or classical one, therefore, introduces a relatively high bending moment into the shell of the casing. The seriousness of this condition can readily be appreciated if considering that for the high head pumps the Metropolitan Water District has specified a test pressure of 520 pounds per square inch. For such conditions the conventional radial ribs used for the reinforcement of volute casings would have had to be made extraordinarily heavy, thereby introducing appreciable foundry difficulties. For this reason a new form of design was developed resembling a short barrel closed by unusually strong covers. This form of design is not only sufficiently strong, but also very rigid, thus preventing distortion of the pump casing under the working pressure which might have proven fatal on account of the unusually close running clearances on the inside of the pump.

Another feature which strikes the eye when inspecting the cross section of the pump is the size of the shaft in connection with the relatively small overhang of the impeller over the pump bearing. The selection of the shaft size is largely due to the above-mentioned laboratory experiments about the unbalanced forces acting on the impeller. It was found that these forces sometimes assumed dangerous proportions. High efficiencies on the other hand require small

clearances between the impeller and the casing. It was for this reason that the rigidity of the shaft became a factor of paramount importance. It may be said in fact that calling attention to this factor is one of the major contributions for which the pump industry is indebted to the research staff of the Metropolitan Water District.

We shall now present a few numerical data concerning the high head pumps:

It has been mentioned before that the total head for these plants is about 440 feet. The capacity per pump is 200 cubic feet per second, or approximately 90,000 gpm, while the speed of rotation is 450 rpm. The resulting specific speed therefore, becomes:

$$n_s = \frac{\text{RPM}\sqrt{\text{GPM}}}{(\text{Head})^{3/4}} = 1330$$

or 63 if the capacity is expressed in cubic feet per second. The power consumption of one unit amounts to about 12,000 HP. which is nearly twice as much as that of the most powerful pump which has been built up to now in the United States. In Europe pumps with as much as 35,000 HP. are in operation, but these pumps are equipped with guide vanes resembling those of high head water turbines. Thereby the problem of the casing design naturally is reduced to a relatively simple one, but the very best efficiencies apparently are not obtainable by this arrangement. It is hoped in fact that the Aqueduct pumps will exceed the larger European pumps by about 5 percent in efficiency, and in this respect as well as regarding the design of the casing they may well be expected to establish a distinct record.

CASINGS

Due to the high head requiring high water velocities inside of the pump the physical dimensions of the latter are not excessively great. The discharge diameter of the pump casing is 42 inches, but a joining diffuser gradually increases this diameter to 60 inches. The inlet diameter decreases from 66 inches in the horizontal portion of the suction pipe to about 50 inches at the pump inlet. Concerning the best shape of the suction elbow laboratory experiments are still in progress.

The problem of the casing design is most readily understood by considering the total pressure which in ordinary volute casings tends to open the horseshoe sections of the volute, and which in our case

is taken up by the bottom, the top cover, the outer shell and the ribs of the casing. This force normally amounts to about 2,500,000 pounds, but temporarily may assume much higher values. Under the test pressure of 520 pounds per square inch this force increases to about 6,000,000 pounds. The casing which has to withstand this load has a weight of approximately 66,000 pounds including the top cover which is integral with the bearing bracket. By this arrangement the top cover becomes so strong that it can be used to stiffen the casing itself by means of a rim reaching over the casing flange, thus reducing the radial deformations of the latter.

The casing and the top cover are, of course, steel castings. In their design great care was taken in order to obtain the best possible foundry result, in particular by a proper choice of the wall thicknesses. The outer shell of the casing will be $2\frac{1}{4}$ inch thick with the joining parts somewhat lighter in order to assure proper feeding.

SHAFTS

It has already been mentioned that next to the casing the dimensions of the shaft deserve special consideration. The diameter of the pump shaft is 22 inches at the bearing, gradually tapering down towards the impeller, while the diameter of the lower part of the intermediate shaft is increased to 24 inches. The sole reason for this unusually heavy shaft is, of course, its rigidity, since the working stresses remain quite low under all operating conditions. It is possible that in this respect the Aqueduct pumps will constitute a precedent for future designs. The shaft is a carbon steel forging with rigid flange couplings and has a central bore of 6 inches in diameter running through its entire length. It has to carry the whole hydraulic thrust since it should not be under compression at any time and because the thrust is being carried by the upper motor bearing.

The stuffing box packing is riding on a monel metal sleeve. The packing is of a semi-metallic type lubricated by grease, thereby obtaining the least possible friction. The stuffing box has to seal only against the suction pressure which varies between +5 and +40 feet of water because the back of the impeller is equipped with a balancing chamber connected with the suction side of the pump.

The impeller is approximately 85 inches in diameter and weighs about 7,000 pounds. It is made from bronze consisting of 89 percent copper and 11 percent phosphorized tin, an alloy which is particularly suited for this purpose. The impeller is machine finished on the

outside and hand finished on the inside, thus minimizing friction losses as well as the danger of pitting, or other forms of erosion. The wearing ring clearance will be approximately $\frac{30}{1000}$ inch on diameter and can be checked through suitably arranged inspection holes.

In concluding this description the writer should like to say that the expected success of these pumps will be due not only to the efforts of a few individuals or one company, but largely to the whole-hearted coöperation of the Metropolitan Water District with the contracting pump companies, and it is to be hoped that this spirit of coöperation will persist beyond the execution of this particular contract.

LIST OF SECTION PAPERS

Central States Section

Cleveland, O., August 19–21, 1936

Cleveland Water Works ..... Frank O. Wallene
Observations in Toronto Filter Plant Laboratories During the Past Twenty-five Years ..... N. J. Howard
Effect of Coal Mine Drainage on West Virginia Rivers and Water Supplies ..... W. W. Hodge
Modern Repair Shop for Distribution System ..... J. S. Dunwoody
Statistical Reports for Water Works Plants ..... A. C. Michael
Symposium on the 1935 Flood and Flood Control Measures:
The 1936 Flood and Pennsylvania Public Water Supplies ..... H. E. Moses
The 1936 Flood and West Virginia Public Water Supplies ..... E. S. Tisdale
The 1936 Flood and Ohio Public Water Supplies ..... F. H. Waring
The Utility of Hydraulic Models to the Designer and Operator ..... George E. Barnes
Jewell Sub-Surface Filter Washing System ..... R. W. Furman
Flows in Settling Basins ..... L. S. Morgan and M. E. Flentje
Proposed Low Industrial Rates for Youngstown Found To Be Discriminatory ..... Philip Burgess

Rocky Mountain Section and Sixth Rocky Mountain Water Works College

Denver, Colo., September 21–23, 1936

Well Water Supplies ..... E. C. Archibald
Cross Connections (Illustrated) ..... J. I. Connolly
Discussion ..... E. B. Clayton
Trans-Mountain Diversion:
Possibilities of—in Colorado ..... R. J. Tipton
Legal Phases of ..... Charles Patterson
Moffat Tunnel Project ..... O. N. Strange
Discussion ..... H. L. Potts
The Magnetite Filter ..... S. I. Zack
Formation of a Sewage Works Section ..... Dana E. Kepner
Discussion ..... L. C. Osborn
Licensing of Water Superintendents and Plant Operators ..... O. J. Ripple
Discussion ..... L. C. Osborn
New West Side Denver Filter Plant ..... L. R. Howson
Discussion ..... O. J. Ripple

Design of Denver Sewage Plant.....A. K. Vickery
Discussion.....F. M. Veatch
Design of Colorado Springs Sewage Plant.....Earl L. Mosley
Discussion.....J. C. King
Design of Greeley Sewage Plant.....R. W. Gelder
Discussion.....Roy Seaman
Round Table Discussion
Developments in Water Supply Practice.....H. C. McClintock
Water Softening.....Dana E. Kepner
Use of Copper Sulphate and Ammonium Sulphate
George Turre and O. J. Ripple
History of Denver Artesian Wells.....H. D. Perry and Geo. C. Koogle

New York Section

Saratoga Springs, N. Y., October 15–16, 1936

Review of Recent Progress in the Elimination of Tastes and Odors
C. R. Cox
Principles of Design of Special Taste and Odor Removal-Plant at South Fallsburg.....E. P. Shinman
Origin and Prevalence of Iron and Manganese and Their Removal
George Willcomb
Iron Removal Plant at Stillwater.....G. R. Solomon and N. J. Wormile
Superintendents' and Plant Operators' Round Table
Led by Messrs. Ackerman, Brush and Wiggins
History of the Water Supply System of Saratoga Springs
S. J. Mott and G. W. Ainsworth
Design of New Filtration Plant of Saratoga Springs.....G. H. Buck
Experiences in the Operation of the Water Filtration Plant
Mr. Caird (Chemical)
Mr. Cherry (Mechanical)
Round Table Discussion

Water Works Meeting

SPONSORED BY NEW JERSEY WATER WORKS ASSOCIATION; SOUTH JERSEY ASSOCIATION OF WATER SUPERINTENDENTS; NEW JERSEY SECTION OF AMERICAN WATER WORKS ASSOCIATION

Atlantic City, N. J., October 23–24, 1936

The New Atlantic City Pipe Line.....S. N. Williams
Atlantic City Storage Reservoir and Basins.....Lincoln Van Gilder
Experiences in Well Construction.....J. A. Carr
Supervision of Cross Connections by the State Department of Health
J. B. Baty
Charges for Fire Protection.....George H. Buck
Water Works Finance and Accounting Practice.....Jacob Schwartz

New Methods and Devices in Water Treatment.....Willem Rudolfs
Discussion.....G. R. Spalding
Deterioration of Pipe and Its Prevention.....William R. Conard
The Correction and Protection of Distributing Systems.....H. S. Hutton
Diesel Engines in Water Works Practice.....W. E. Wechter
Discussion.....W. J. Schiverea
Round Table Discussion.....Led by C. W. Dare

Missouri Valley Section with Missouri Water and Sewage Conference and Kansas Water and Sewage Works Association

Kansas City, Mo., October 26–28, 1936

Round Table Discussion (Unusual water works operation problems during the winter and summer seasons of 1936)
The Kansas City, Missouri, Water Works.....Geo. F. Gilkinson
The Kansas City, Kansas, Water Works.....Jas. D. Donovan
Recent Water Works Improvements at Little Rock, Arkansas
Chester A. Smith
The American Water Works Association.....W. W. Hurlbut
What Becomes of Water After It Leaves the Pumping Plant?
H. V. Pedersen
The Value of Thiosulphate-Treated Bottles for Counts on Shipped Swimming Pool Samples.....Cassandra Ritter
The New Automatic Zeolite Water Softening Plant at Glidden, Iowa
C. M. Stanley
Recent Improvements in Water Treatment Methods....Jack J. Hinman, Jr.
Improvements in Water Works Equipment and Materials.....C. I. Dodd
Tastes and Odor Problems in Water Supplies from the Missouri and Kaw Rivers.....William T. Bailey, Geo. F. Gilkinson, John P. Smouse, L. B. Mangun, Frank E. Willey
The Disposal of Brines from Oil Drilling and Petroleum Operations
Earnest Boyce
Water Hammer: Correcting an Unusual Problem.....V. C. Lischer
Vacuum Breakers and Siphon Preventors in the Plumbing System
F. M. Dawson and A. A. Kalinske
Transite Pipe and the Report of the Committee of the New England Water Works Association on Pipe Line Friction Coefficients.....R. F. Orth

Wisconsin Section

Waukesha, Wis., October 6–7, 1936

History of Waukesha Water Department and Waukesha Spring Water Development.....A. P. Kuranz
The Viewpoint of the Public Service Commission with Reference to Wisconsin Water Utilities.....Geo. P. Steinmetz
Pension Systems Based on Insurance.....Merrill Taft
Round Table Discussion on Cold Weather Experiences
Led by Walter A. Peirce

Round Table Discussion on Hot Weather Experiences
Led by C. P. Gross and Harold L. Lando
Modern Trends in Water Purification Practice.....F. H. Waring
Safe Handling of Chlorine and Ammonia at Water Works Plants
H. H. Gerstein
General Review of the Good and Bad Vacuum Breakers and Syphon Preventors.....Frank M. Dawson
Water Borne Diseases.....H. M. Guilford
Fluorine Content of Some Wisconsin Drinking Waters....M. Starr Nichols
Design Features of the Milwaukee Filtration Plant.....Herbert H. Brown
The Design of the Water Works System for Greendale, and Other Federal Projects.....Elmer Becker
The Successful Campaign in Neenah for Water Program Approval
S. F. Shattuck
The Rôle that Diesel Engines Play in Water Works.....Bruno Nordberg
Movie—Manufacture of Copper Tubing
Mr. Irwin of Chase Brass & Copper Co.
Water Utility Accounting and Records.....W. C. Staeffler
Gate Valves and Hydrants.....Clarence Gruetzmacher
The Pitometer Method of Water Waste Detection.....A. E. Skinner
Round Table Discussion of Distribution System Maintenance
Led by A. H. Miller
Licensing of Water Works Operators.....Wm. U. Gallaher

Southwest Section

Fort Smith, Ark., October 12–15, 1936

Cost Accounting and Records.....Lloyd Rebsamen
Office Records and Machine Billing.....H. E. Reiman
Coördination of Plant, Distribution System and Office.....Thos. L. Amiss
Licensing of Water Works Operators.....H. J. Darcey
Water Supplies for Interstate Carriers.....H. N. Olds
Identification of Algae, Their Control, Taste and Odor Removal
F. R. Hassler, Jr.
What Water Works and Sewer Improvements Have Meant to Cities in Arkansas.....M. Z. Bair
History of the Fort Smith Water Department.....H. S. Peck
New Gravity Water Supply for Fort Smith.....W. R. Holway
Stream Gauging.....J. H. Gardiner
Water Conditioning for Industrial Use.....R. E. Damp
Various Chemical Tests and Analyses for the Proper Control of Water Conditioning.....Dr. Harrison Hale
The Interpretation of Water Analyses for Industrial Use...Dr. O. M. Smith
Selection of Coagulants.....L. C. Billings
What Revenue Requirements Must Be Met Before Water Company Will Extend Its Distribution Mains.....Albert R. Davis
Control of Size of Service Connections.....M. B. Cunningham
The Annual Report.....J. B. Winder
Maintenance and Operation of Long Flow Lines.....W. F. McMurry

What the Cost of a Water Works and Sewer System Means to the Average Community for Fire Prevention.....H. R. F. Helland
Ground Water in the Southwest.....Dr. George C. Branner
Types of Wells and Their Construction.....R. M. King
Well Equipment.....A. O. Fabrin
Depreciation in Yield and Maintenance.....C. M. McCord
Treatment of Underground Water.....E. L. Filby

North Carolina Section and North Carolina Sewage Works Association

Charlotte, N. C., October 26–28, 1936

The Water Supply and Sewage Treatment Facilities of Charlotte..W. E. Vest
The Mountain Island and River Bend Plants of the Duke Power Co.
Representatives of Duke Power Co.
Cleaning of Filter Sands with Acids.....J. C. Geyer
Development of Water Works and Sanitation Through P.W.A. in North Carolina.....Stanley H. Wright
Practical Application of Laboratory Tests in Water and Sewage Treatment
H. E. Thompson
Chlorine Determinations.....L. L. Hedgepeth
Discussion.....Led by P. W. Frisk, J. H. Henderlite and N. D. Doane
Drainage Basins—Studies of the National Resources Committee..W. M. Piatt
Safety First in Water and Sewage Plant Operation
(a) Water Works Phase.....C. F. Bingham
(b) Sewerage Phase.....H. A. Faber
The Opportunity of the American Water Works Association..H. E. Jordan
Activated Carbon in Sewage Treatment.....R. W. Haywood, Jr.

Virginia Section and Virginia Sewage Works Association

Charlottesville, Va., October 29–30, 1936

Underground Dam at Harrisonburg.....A. B. McDaniel
Discussion.....W. G. Meyers
The Importance of Public Interest in the Local Water Works..W. W. Brush
Conservation and Development of Water Resources in Virginia
Hon. Wilbur C. Hall
"Free for All" Discussion of Water Supply and Purification Problems
Interesting Water Works Problems
At Orange.....R. L. Blankenship
In Henrico County.....George Hawkins
At Hopewell.....G. L. Spratley
New Sewage Treatment Plant for Bluefield, West Virginia—Virginia
George L. Richardson
Design of the Plant.....M. G. Mansfield
Water Works and the Water Works Manufacturer.....W. J. Orchard
Novel Features of Filtration Plant at Lexington.....W. Martin Johnson
"Free for All" Discussion of Water Treatment and Distribution Problems
Led by A. L. Meisel
Moving Pictures—Microscopy of Water.....Courtesy City of Allentown, Pa.

SOCIETY AFFAIRS

THE ANNUAL CONVENTION

The fifty-sixth Annual Convention of the American Water Works Association was held at the Hotel Biltmore, Los Angeles, California, on June 8 to 12, 1936.

The Board of Directors held its meeting on June 7 and endorsed the action taken by the General Policy Committee in changing the Headquarters' Staff, including the designation of Secretary Little as Secretary Emeritus, at a salary of $2,500 per annum. The Board expressed its opinion that the compensation of Secretary Emeritus Little should continue throughout his lifetime. The General Policy Committee was continued with power to complete the work of reorganizing the secretarial office.

The George W. Fuller Memorial Committee, consisting of Willard Chevalier, Thomas W. Wiggin and Arthur E. Gorman, Chairman, recommended a "living memorial" in the form of memorial memberships as follows:

1. That memorial memberships be established in Sections of the Association on the basis of at least one membership for each Section and possible multiple memberships for certain of the larger Sections.

2. That these memberships be known as the George W. Fuller Memorial Memberships.

3. That they be awarded to employees of public water works, whether municipal or private, for meritorious performance in improving water works service or for proficiency of work at a water works training school sponsored by or conducted in cooperation with the American Water Works Association or any of its Sections, the recipients of these awards to be selected in such manner as may be established by a committee hereinafter provided for.

4. That each recipient of a memorial membership be given full active membership in the Association for twelve months without payment of dues and also a certificate of award bearing a likeness of George W. Fuller and signed by the President and Secretary of the Association.

5. That the ceremony of award be made a part of the annual meet-

ing of the respective Section making same, at which time suitable emphasis should be given to the noteworthy service of George W. Fuller to the water works profession and the American Water Works Association in particular.

6. That at the annual convention of the Association the names of the recipients be announced in some appropriate manner.

7. That in the published list of members of the Association a designation be made indicating members who have been awarded the George W. Fuller Memorial memberships.

8. That a committee of five members of the Association be appointed to work out the necessary administrative procedure for directing these memorials in cooperation with the officers of the various Sections.

At the Thursday meeting of the Board, the committee was continued, to complete details and make a further report to the Board.

Monday Morning June 8

At the opening session of the convention on Monday morning, June 8, progress reports were submitted by Committee 1, Basic Data, Elson T. Killam, Chairman, and Committee 5, Quality and Treatment of Water, Paul Hansen, Chairman.

Sub-Committee 51-D, "Standards of Quality of Water and Joint Editorial Committee on Standard Methods for the Examination of Water and Sewage," presented a report through Harry E. Jordan, Chairman, reviewing the work done by the committee and stating that the revised Eighth edition of Standard Methods was in the hands of the printer and would be shortly available.

Sub-Committee 7-A, "Steel Plate Pipe for Water Supply," Leonard P. Wood, Chairman, reported that specifications for rivetted, lock bar and fusion welded steel pipe were well advanced and also specifications for coating such pipe, the report indicating this work was being actively prosecuted.

Sub-Committee 7-E, "Valves, Sluice Gates and Fire Hydrants", William R. Conard, Chairman, sent a progress report, which was read by Acting Secretary Wilson.

Sub-Committee 7-H "Steel Standpipes and Elevated Tanks," Louis R. Howson, Chairman, reported that specifications had been published in the 1931 *Journal* and that the final draft of the specifications for rivetted work had been submitted at the Cincinnati convention in 1935, with a general specification for welded work. Sub-

sequently the committee had reviewed these specifications and it had been decided to eliminate the specifications for welding and appoint a new committee to draft such specifications, which was now being done. The specifications for rivetted work were published in the Journal, November, 1935, and as the work of the committee was completed, it should be released. President Barbour announced that these specifications had been approved by the Board of Directors on June 7, 1936.

Sub-Committee 7-T, Transite Pipe, Clarence R. Knowles, Chairman, prepared a progress report, which was read by Acting Secretary Wilson. Mr. Knowles stated that the extensive tests of transite pipe were being carried out for the manufacturers by independent agencies and until these tests were completed, a comprehensive report could not be made.

"Committee on Electrolysis and Electrical Interference," Nicholas S. Hill, Jr., Chairman, submitted a verbal report through M. W. Cowles, who is a member of the Committee. Mr. Cowles reviewed the work since the Cincinnati convention, when the previous approval of grounding on water pipes was withdrawn. As a result of this action, the Electric Code covering grounding was not approved by the A. W. W. A. representative. Subsequently with the cooperation of the American Standards Association, a new committee has been formed under the joint sponsorship of the A. W. W. A. and the Edison Electrical Institute, and an extensive study of the whole subject of electric grounding is to be undertaken.

The report of "Committee on Uniform Marking of Fire Hydrants," Stephen H. Taylor, Chairman, was read by William W. Brush, and recommended the adoption of the color scheme of marking hydrants to indicate approximate capacity. Professor Lewis V. Carpenter stated the Central States Section was in favor of such marking and C. W. Mowry, Fire Protection Engineer, Boston, Mass., also favored the adoption of the report and stated the system was intended mainly for small communities. H. W. Dowler, Superintendent, Seattle, Wash., stated that in Seattle, 10,000 hydrants had been painted in accordance with the Committee recommendations, whereas previously the hydrants had been painted to indicate pressure on the hydrant and that the Fire Department was in favor of the pressure marking system.

At the suggestion of Harry E. Jordan, it was decided to print the report in the Journal, with an explanatory note and the committee is

to submit a further report to the Board of Directors in January, 1937.

"Committee on Water Works Short Schools and Licensing of Water Works Employees," Lewis V. Carpenter, Chairman, stated in its report that this work is vital to the Association and its members. A year ago at the Cincinnati convention, the desirable qualifications for the three grades of operators were given and since then efforts have been made to increase interest in licensing. The action of the California Section in establishing voluntary licensing and similar action by the Texas Health Department are encouraging signs, as well as the activities of the Southeast and Wisconsin Sections. Prof. Carpenter stated that the short schools are considered the best agency for negotiation with the water works operators.

"Committee on Hazards to Plant and Personnel from the Use of Chlorine and Other Chemicals," Marsden C. Smith, Chairman, reported that the subject of chlorine had been covered a year ago and that ammonia was covered in the report now submitted. The committee, with but one exception, is of the opinion that other chemicals which might involve hazards are not used sufficiently to justify consideration by the committee. The future work of the committee will be to collect data on the frequency and seriousness of accidents involving chemicals and the causes of such accidents.

No report was received from the "Joint Committee on Water Works Terms" and Committee 3, "Surface Water Collection," Thorndike Saville, Chairman.

"Section Committee on Specifications for Cast Iron Pipe" (A. S. A. Committee A-21) Thomas H. Wiggin, Chairman, reviewed the work of the committee, which was created ten years ago. A vast amount of experimental and investigational work has been done during the life of the committee, the cost being met by a fund of some $70,000, contributed mainly by pipe manufacturers. In addition to tests of pipe, fittings have been tested both for strength and hydraulic properties. In sizes 12-inch and smaller, the results are complete, but in the larger sizes further tests are to be made, due to weaknesses disclosed by the tests. The specifications and schedule of dimensions, together with a manual explaining the work done and methods followed in setting up thicknesses, will be completed during the coming year.

"National Water Policy Committee," Abel Wolman, Chairman, reported that this committee which was appointed at the Cincinnati

convention, had been engaged mainly in negotiations with the National Resources Committee at Washington on questions relating to the activities and policies of the National Committee and on legislation introduced into Congress during the past six months. The A. W. W. A. Committee had in January a joint meeting with the American Society of Civil Engineers' Committee and the National Committee on Water Resources and another meeting is scheduled for July, 1936. Probably none of the bills introduced will pass at this session of Congress. This report was discussed by L. R. Howson, T. A. Leisen and Prof. S. B. Morris.

At the close of the committee reports, the convention was opened by President Frank A. Barbour, who announced the election as President for 1936–37 of William W. Hurlbut, Engineer of Water Works, Los Angeles, Cal., and as Treasurer William W. Brush, Editor, Water Works Engineering, New York.

The report of the Secretary was given by Acting Secretary Wilson, who reported the largest net gain in membership in any year in the history of the Association, amounting to 332, one new section was added, the New Jersey Section, and the leadership of the Association in requiring adequate sanitation at hotel headquarters was continued. The financial outlook for 1936 was favorable, based on the results for the first four months. The report of the Treasurer was given, together with that of the Board of Directors.

The President introduced George H. Felix, former president of the Board of Water Commissioners, Reading, Pa., who is next to the oldest living member of the Association. He joined in 1893 and has attended both of the California Annual Conventions. Mr. Felix served as President of the Association in 1908–1909.

In the President's address under the title "What's Ahead for A. W. W. A.," Mr. Barbour stated that the answer "depends on the realization of the opportunity open to the Association to become a vigorous, well coördinated service agency for the entire water works field—not only technically but in activities looking toward improved public relations and the betterment of the economic and social status of water works personnel."

In his opinion, the milestones in the progress toward advancing the knowledge of water works are the formation of sections in 1914, the formation of the Standardization Council in 1920, the publication of the Manual of Water Works Practice in 1928 and the establishment of the technical divisions in 1924.

Mr. Barbour believes that the twenty-one sections constitute the most important asset of the Association from the view point of future service to the general membership. He urged the development of the headquarters staff to relieve the general membership of some of the now burdensome volunteer service in the Water Works Practice Committee and the Publication Committee. He urged the formation of more sections along state lines, the assembling of basic data and operating statistics at headquarters, the issuance of a new edition of the Manual and the improvement of municipal civil service conditions and the betterment of the economic and social status of the operating membership.

Monday Afternoon, June 8

At the afternoon session, which was the opening meeting of the Plant Management and Operation Division, the presiding officer was William W. Hurlbut, Chairman of the Division.

The first paper was "Experience with Automatic Control Equipment at Pumping Stations," by H. A. Harris, Jr., Assistant Engineer, California Water Service Company, San Francisco, Cal.

L. L. Lewis, and L. H. Polderman, presented a paper on "Modern Air Conditioning—What It Means to the Water Utility." It was read by Mr. Polderman. The discussion scheduled by J. S. Strohmeyer, Distribution Engineer, Bureau of Water Supply, Baltimore, Md., was not given. The discussion by M. K. Fahnestock, Research Assistant Professor of Mechanical Engineering, University of Illinois, Urbana, Ill., was read by Prof. Harold E. Babbitt of the University. Thomas H. Wiggin, New York, told of the driving of wells within the limits of New York City to secure water to cool air and the requirement by the State Water Power and Control Commission to return the water to the ground in an uncontaminated condition. Arthur E. Gorman, Chicago, Ill., directed attention to the public health menace created by the use of water for air conditioning and delivery of polluted water into the public water supply system. He stated that in Chicago the re-use of water was mainly the cause of the outbreak of amebic dysentery and that great care should be exercised to see that improper cross-connections are not made.

A description of the water system at Waco, Texas, was given by George J. Rohan, Superintendent, in his paper "Operating Experiences in Water Supply at Waco, Texas."

Something different from the usual run of papers was presented by

H. V. Pedersen, General Manager, Water Works, Marshalltown, Ia. He described "Some Interesting Facts Uncovered in a Survey of Properties not Served With City Water."

Tuesday Morning, June 9

Tuesday was designated as "California Day," and the program that day for the main sessions was based upon California conditions and developments. The opening paper was "Romance and Development of the Los Angeles Water Supply," by H. A. Van Norman, Chief Engineer and General Manager, Bureau of Water Works and Supply, Department of Water and Power, Los Angeles, Cal. Discussion was led by T. L. Bristol, Paul Hansen and L. R. Howson.

"Benefits Accruing from the Hetch Hetchy Project of the San Francisco Water Supply," was presented by N. A. Eckart, General Manager and Chief Engineer, Water Department, San Francisco, Cal. Mr. George W. Pracy, Superintendent, Water Department, San Francisco, discussed this paper. Further discussion was had by Messrs. Pollard, W. W. Brush, A. E. Gorman, L. R. Howson and H. D. Fowler.

"Progress on the Colorado River Aqueduct of the Metropolitan Water District of Southern California" was presented by Franklin Thomas, Vice Chairman, Board of Directors, Metropolitan Water District of Southern California, and Professor of Civil Engineering, California Institute of Technology, Pasadena, Cal.

Mr. M. Spillmann, Chief Engineer, Worthington Pump & Machinery Corporation, Los Angeles, delivered a paper on "Features of Equipment and Design of Pumping Stations on the Colorado River Aqueduct."

An outline of the equipment and work done in the special laboratory that was established at the California Institute of Technology for the purpose of carrying on experiments in connection with the equipment and design of the pumping stations on the Colorado River aqueduct was given by Robert L. Daugherty, Professor of Mechanical and Hydraulic Engineering, California Institute of Technology, Pasadena, Cal.

A history of the development of the Owens Valley water system for Los Angeles was contained in the paper on "The Dual Usage of Water for Domestic and Irrigation Purposes" by J. B. Lippincott, Consulting Engineer, Los Angeles. This paper was discussed by D. W. Trauger, Superintendent, Lindsay-Strathmore Irrigation District, Lindsay, Cal.

"Experience in Ground Water Depletion by Unregulated Pumping" was described by William W. Brush, Editor, Water Works Engineering, New York. This paper was discussed by T. H. Wiggin and H. Conkling.

A paper on "The Value of and Methods Used in Artificial Storing of Ground Water by Spreading," was presented by D. A. Lane, Assistant Engineer, Bureau of Water Works and Supply, Department of Water and Power, Los Angeles, Cal.

A lengthy report describing the "Recent Federal Activities in the Conservation of Water Resources" was presented by Abel Wolman, Chairman, National Resources Committee. This paper was discussed by S. B. Morris and C. G. Gillespie.

Wednesday Morning, June 10

Cost of tuberculation

At the Wednesday morning main technical session, a symposium was presented on the "Cost of Tuberculation." This was opened by a digest of the report of the New England Water Works Association Committee on Friction Coefficients of Pipe Lines, which was prepared by Elson T. Killam, Chairman. As Mr. Killam was not able to be present, President Barbour gave a summary of the report, illustrated by lantern slides.

Mr. Frank A. Barbour, Consulting Engineer, and President of the A. W. W. A., presented a brief paper on "Economic Significance of Improved Pipe Linings."

A paper, complete with charts and informative tables on the subject of "Observations of Conditions of Mains in Typical American Cities—the Effects of Water Quality and Protective Linings," was presented by Edgar K. Wilson, Chief Engineer, The Pitometer Company, New York City.

"Experience in Rehabilitation of a Large Main," was treated in a joint paper prepared by Clinton Inglee, President and General Manager, National Water Main Cleaning Company, New York City, and W. B. Banks, Division Engineer, Water Department, Newark, N. J. This paper was discussed by Fred B. Nelson, Engineer, Department of Water Supply, Gas & Electricity, New York, N. Y.

The concluding paper of the symposium was on "Protective Treatment of Steel Lines as Developed in the Los Angeles Bureau of Water Works and Supply," by Harry Hayes, Assistant Engineer, Field Engineering Laboratory, Bureau of Water Works and Supply,

Los Angeles, Cal. Mr. Hayes' paper was discussed by L. E. Goit. Mr. T. H. Wiggin reviewed the advances that have been made in recent years in both cement and bituminous pipe linings.

Thursday Morning, June 11

There were no technical sessions for Wednesday afternoon, but on Thursday morning, there was a joint session of the General Membership and Water Purification Division, the first paper being on "Iron Removal Without Aeration. The Precipitation of Ferrous Carbonate in a Closed System," by Frank E. Hale, Director of Laboratories, Department of Water Supply, Gas & Electricity, New York, N. Y. Charles R. Cox read the discussion on this paper that had been prepared by Robert Spurr Weston, who was unable to attend the convention. Prof. L. V. Carpenter also discussed the paper.

"Developments in Raw Water Preparation and the Use of Chlorinated Copperas at Richmond, Va." was described by Marsden C. Smith, Engineer, Bureau of Water and Electricity, Richmond, Va. Mr. Smith's paper was discussed by L. L. Hedgepath, Ralph A. Stevenson and L. I. Birdsall.

"Dams, Pipe Lines, Pumping" were discussed by Samuel B. Morris, Professor of Civil Engineering, Stanford University, California.

"Water Treatment" was reviewed by Linn H. Enslow, Editor, Water Works and Sewage, New York City.

"Distribution Practice" was presented by W. W. Brush, Editor, Water Works Engineering, New York City.

"Seen and Heard in the Field" was the subject of the talk given by Fred E. Stuart, Research Engineer, Activated Alum Corporation, New York City. The discussion that was to have been given by L. B. Reynolds, Professor of Hydraulic and Sanitary Engineering, Stanford University, Cal., was presented by R. F. Brown, the new President of the California Section. A discussion by George D. Norcom was read by W. W. DeBerard.

Thursday Afternoon, June 11

At the Thursday afternoon session, a statement of the Committee on Electrolysis and Electrical Interference, on Present Status of the Grounding Problem and on the Program of the New Joint American Research Committee on Grounding, prepared by Charles F. Meyerherm, President and Engineer, Albert F. Ganz, Inc., New York, N. Y., was presented by M. W. Cowles, New Milford, N. J.

M. Warren Cowles, Hackensack Water Company, Filtration Plant, New Milford, N. J., outlined the story of the formation and organization of a new group to study the problem of electrolysis. The discussion was opened by R. R. Ashline, Electrolysis Engineer, Los Angeles Bureau of Water Works and Supply.

President Barbour then turned over the chair to E. F. Dugger, Superintendent, Newport News, Va., who is the director representing the Virginia Section.

"Residual Chlorinators as Used in the Los Angeles System," were described by Ray F. Goudey, Sanitary Engineer, Bureau of Water Works and Supply, Department of Water and Power, Los Angeles, Cal.

"Record Control of the Construction, Maintenance and Operation of Distribution Systems" was described by E. W. Breitkreutz, Assistant Engineer, Distribution, Operation and Construction, Bureau of Water Works and Supply, Department of Water and Power, Los Angeles, Cal.

"The Memphis Meter and Leak Tester" was described by C. M. McCord, General Superintendent, Light and Water Division, Memphis, Tenn.

Thursday Afternoon, June 11

Superintendents' Round Table

The first subject in the Superintendent's Round Table discussion was "What Per Cent of Income of Water Utilities is Justified for Use in Plant and Property Beautification?" by George W. Pracy, Superintendent, Water Department, San Francisco, Cal.

"Jointing Materials for Water Mains—Experience with Cement," was presented by F. M. Murphy, Superintendent of Distribution, City Water Works, El Paso, Texas. This paper was commented on by Mr. Hurlbut and Mr. F. S. Porter.

Mr. A. M. Brenneke, City Engineer, Denison, Texas, was not able to be present to discuss the "Disinfection of New and Repaired Mains."

An announcement was made of the officers for the national divisions for the coming year, as follows:

Finance and Accounting Division:
Chairman, Hal F. Smith, Department of Water Supply, Detroit, Mich.
Vice-Chairman, Jacob Schwartz, Board of Public Utilities Commissioners of New Jersey, Newark, N. J.

Directors, John H. Murdock, Jr., Washington, Pa.; Louis D. Blum, Certified Public Accountant, N. Y.

Plant Management and Operating Division:

Chairman, W. Victor Weir, Superintendent, St. Louis County Water Company, University City, Mo.

Vice-Chairman, Thomas J. Skinker, St. Louis, Mo.

Secretary-Treasurer, P. S. Wilson, Consulting Engineer, N. Y.

Directors, R. B. Simms, Spartanburg, S. C.; William W. Hurlbut, Los Angeles, Calif.

Water Purification Division:

Chairman, Carl L. Lauter, Chief Chemist, Dalecarlia Filter Plant, Washington, D. C.

Vice Chairman, William M. Wallace, Filtration Plant, Detroit, Mich.

Secretary-Treasurer, Charles R. Cox, State Dept. of Health, Albany, N. Y.

Trustees, Mathew M. Braidech, Cleveland, Ohio; Albert E. Berry, Toronto, Ont.; Charles G. Hyde, Berkeley, Calif.

An announcement was made that the Franklin Henshaw cup had been awarded to the Montana Section for an attendance of 92.04 per cent and that the Virginia Section was a close second with an attendance record of over 91 per cent. The Nicholas S. Hill, Jr., cup was won by the Rocky Mountain Section for the maximum percentage increase in membership, with the California Section second.

President-elect Hurlbut was introduced by retiring-President Barbour and expressed his appreciation at the attendance at the various meetings of the Convention and stated that in the Los Angeles Water Department 87 employees are members of the American Water Works Association.

A vote of thanks was given to the California Section for the effective work done by that Section in planning for and taking care of the Convention.

Finance and Accounting Division

On Wednesday and Thursday forenoon, the Finance and Accounting Division held separate sessions, the attendance reaching fifty. These meetings were featured by informal and interesting discussions of the subjects presented, including the round table discussion at the luncheon on Thursday, in reference to "Uniform Classification of Accounts."

At the opening session on Wednesday, "The Attorney System as a Modern Method of Collecting Water Accounts" was presented by

Samuel W. Zerman, Counsellor at Law, Hackensack Water Company, Weehawken, N. J.

Mr. Hal F. Smith, Head Clerk, Water Consumers' Accounts, Department of Water Supply, Detroit, Mich., presented a paper on "The Trend of Customer Accounting Practice."

"Reorganization Experiences in Denver, 1933–1936" were described by E. G. Plowman, formerly Executive Assistant, Water Board, Denver. The paper was read by W. W. DeBerard in the absence of the author.

A paper on "Present Trends Toward Simplification of Rate Case Procedure," was presented by Jacob Schwartz, Attorney, Newark, N. J.

"Application of Tabulating Equipment in Accounting Procedure" was explained by Frank Twohy, Department of Water and Power, Los Angeles, Cal.

Mr. H. L. Meites, Superintendent, Chicago, outlined his experiences in "Overcoming Public Opposition to Water Meters."

"Public Relations" was the title of the paper presented by James E. McCaffrey, representative for Southern California of the California Railroad Commission.

Mr. Samuel Leask, Jr., member, Unemployment Reserves Commission, of the State of California, Santa Cruz, spoke on "Unemployment Compensation—Some Pertinent Considerations."

Water Purification Division

Many interesting and timely papers were presented before the sessions of the Purification Division which held three sessions—Monday afternoon, June 8; Tuesday forenoon and Tuesday afternoon—and a joint session with the main body of the Association on Thursday afternoon.

Mathew M. Braidech, Cleveland, presented a review of the report of Sub-Committee on specifications and tests for activated carbons. The Committee recommends that the prepared monograph be made available in mimeographed form at an early date and that these recommendations be tentatively adopted for one year.

"Methods of Testing and Significance of Boron in Water Supplies" was the subject of a paper by Ray L. Derby.

Mr. Joseph M. Sanchis, Los Angeles, presented a paper on "Methods of Testing and Significance of Fluorine and Fluorides in Water Supplies."

"Plankton and Insect Larvae Control in California Waters" was presented by Gerald E. Arnold, Millbrae, California. L. H. Enslow, New York, described the method of applying copper sulphate near the shore used in Atlanta.

Eskel Nordell, New York, presented a paper entitled "Iron and Manganese Removal by Zeolites and Manganese Zeolite Processes."

"The Use of Beds of Manganese in Iron and Manganese Removal" was the subject of the paper presented by William G. Kirchoffer, Madison, Wisconsin.

Prof. W. F. Langelier, University of California, presented a paper on "Analytical Control of Anti-Corrosion Treatment." This paper was discussed by Mr. S. T. Powell, Baltimore, Md.

"Mixing" by Carl M. Hoskinson, Sacramento, California, was presented at this meeting. This paper was discussed by Marsden Smith, Mr. Murray of Iowa and A. S. Hibbs of Cincinnati.

Mr. Kenneth W. Brown, Stockton, California, presented a paper entitled "Coagulation."

"Filter Design as Related to Operation," was the subject of the paper presented by Harry N. Jenks, Berkeley, California.

Mr. Joseph DeCosta, Oakland, California, read the paper entitled "Filtration Without Preliminary Coagulation."

Mr. John Perhab, Beverly Hills, California, presented a paper on "The Maintenance of Filtration Plant Equipment."

Dinner Meetings

On Thursday evening at the dinner dance, Linn H. Enslow, Chairman John M. Diven Memorial Medal Committee, made the presentation to Harry E. Jordan, for the outstanding work of Mr. Jordan for the Association. In the absence of Chairman Morris, of the John M. Goodell Prize Committee, William W. Brush, New York, presented this award to Mathew M. Braidech, Senior Chemist, Baldwin Filtration Plant, Cleveland, Ohio, for his paper on "The Spectrographic Determination of Minor Chemical Constituents in Various Water Supplies in the United States," of which Mr. Braidech was co-author with S. H. Emery, who is not a member of the Association.

President Barbour introduced the newly elected Honorary Members, Moses N. Baker, former Editor of Engineering News-Record, Montclair, N. J.; Dr. Edward Bartow, Professor of Chemistry and Chemical Engineering, State University of Iowa, Iowa City, Ia.;

Charles R. Henderson, Manager, Davenport Water Co., Davenport, Ia.; Nicholas S. Hill, Jr., Consulting Engineer, New York, and Edward E. Wall, Director of Public Utilities, St. Louis, Mo. With the exception of Mr. Baker, all of the new Honorary Members are past-Presidents of the Association.

On Monday evening, the informal reception and dance was held at the Hotel Biltmore. On Tuesday evening, over 600 gathered for the All-Division dinner, at which Bill Orchard was as usual the Master of Ceremonies. Those who assisted Bill in giving the performances, were as follows: From the Los Angeles Bureau of Water Supply, "Golden State Four," Charlie Ramey, Harry Sloat, George Sopp and Bob Totten. From the Utilities Supply Company of Los Angeles "Dud" Dudley, from Western Construction News, "Newt" Withers, and from the National Water Main Cleaning Company, New York City, Clinton Inglee.

On Wednesday morning, a large number of those attending the Convention including the ladies, were guests at the Los Angeles Breakfast Club the breakfast being held at the Ambassador Hotel. The Toastmaster was Donald C. Baker, Consulting Engineer, Los Angeles, Cal., and Colonel Willard Chavelier, Vice-President, McGraw Hill Publishing Co. responded for the water works men under the title "What is Back of the Faucet?" giving the story of what happened before a safe water supply is delivered at the home.

Both the Wednesday evening smoker and the Thursday dinner dance were held in the bowl of the Biltmore, and at the dinner over 1,000 were present.

On Friday, over 300 accepted the joint invitation of the California Section and the Los Angeles Water Department to participate in a 100 mile automobile trip around the city, visiting various reservoirs connected with the water supply system. A barbecue luncheon was served by the Water Department at the Chatsworth Reservoir. Those present at the luncheon were welcomed by President-elect Hurlbut and by Director of Public Relations, Dr. Eby. In the absence of President Barbour, Treasurer William W. Brush, New York, responded for the Association and expressed appreciation of the very effective work that had been done to make the Los Angeles Convention one of the most valuable of the Association.

ABSTRACTS OF WATER WORKS LITERATURE

FRANK HANNAN

Key: American Journal of Public Health, 12: 1, 16, January, 1922. The figure 12 refers to the volume, 1 to the number of the issue, and 16 to the page of the journal.

Serving Disease to Consumers via Pipes and Fixtures. JOEL I. CONNOLLY. Water Works Engineering, 89: 11, 631, May 27, 1936. A connection between the drinking water supply and a secondary system exposes water users to whatever contamination may enter the secondary supply. This is thought to have been the cause of Chicago outbreak of amebic dysentery in 1933. Water from city supply was used in ice-machine condenser for cooling carbon dioxide and then run into tank open to the atmosphere used as secondary supply. Cross-connections existing from a sewer pipe to the condenser discharge pipes made it possible for sewage to flow into the tank, thus contaminating the secondary supply. High buildings with secondary pumping constitute a particular hazard. Plumbing fixtures supplied with water below the rim are very hazardous. Hospital utensil sterilizers and instrument sterilizers, having bottom water supply connections are likewise dangerous. Among dangerous cross-connections observed were one to a cyanide solution tank in a silver plating establishment, one to a hospital tank where dead tissue and organs were washed, and others. A partial vacuum in water distribution system may cause siphonage from improper plumbing fixtures into water lines. Vacuum-recording gages show periods of vacuum frequently occurring in plumbing systems of many large buildings. A potential hazard also occurs when sewage pumps are primed through cross-connections to water supply. Liberal outlay for plumbing inspection is justified.—*Lewis V. Carpenter.*

Emergency Repairs. N. N. WOLPERT. Water Works Engineering, 89: 11, 636, May 27, 1936. Baltimore's equipment for emergency repairs is discussed. Repair crew has radio tuned to short wave police calls and emergencies are broadcast to them. Thawing of services is performed by city with home-built apparatus. Department has ten air compressors for breaking pavement and air cracking mains. Ample stocks are carried of emergency construction material.—*Lewis V. Carpenter.*

How 2,000 Water Projects Were Made Possible. HAROLD L. ICKES. Water Works Engineering, 89: 11, 643, May 27, 1936. Secretary of the Interior gives summary of what was accomplished by P.W.A. in water works field. Over 2,000 water works were built, or improved, with the work 75 percent complete on April 1, 1935.—*Lewis V. Carpenter.*

Obsolescence: or, When it Pays to Spend. FRED SHEPPERD. Water Works Engineering, **89**: 11, 651, May 27, 1936. Replacement of pumping units is justified when power savings effected by new equipment are sufficient both to pay interest on investment necessary and to retire the principal within probable efficient life of the installation. Return of the principal in less than this period represents profit to the water works. Improvement of pumps, particularly of those of centrifugal type, during past 20 years has rendered a very large percentage of those now in service obsolete. Examples are cited of three cities which, by replacing old pumping units with new, effected large savings in power.—*Lewis V. Carpenter.*

Minimizing the Human Element in Water Works Operation. NICHOLAS S. HILL. Water Works Engineering, **89**: 11, 664. May 27, 1936. Mechanical equipment for coal and ash handling, automatic stokers, and increased use of steam turbines lend themselves to automatic operation. Electric motors are well adapted to push button control and large electric pumping stations are being controlled from a desk panel board. Harrison St. pumping station in Chicago is being converted from steam to electric power, with estimated saving in labor cost of $245,776 per year. Numerous examples of automatic operation are cited. Development of telemetering and of telephone supervisory control has improved operation by keeping operators informed of conditions at remote points. Progress is also being made in reducing the amount of labor required in purification plants. Automatic control of valves, chlorination, and adoption of photoelectric cells and electrical potentiometers are eliminating the personal element more and more. Automatic zeolite water softening plants are in operation at Utica and at East Rochester, N. Y. Operation centers around motorized multiport valves. Photo-electric device for automatically giving notice of sudden rise in turbidity is in use at Denver. Improvements have likewise been made in storage yard handling and billing.—*Lewis V. Carpenter.*

New Developments and Trends in Water Treatment. F. M. DAWSON. Water Works Engineering, **89**: 11, 683, May 27, 1936. The great increase in use of activated carbon for taste and odor removal is the one outstanding development in water treatment of recent years. On highly colored water, excellent results have been obtained by passing it first through one ordinary pressure filter filled with sand and then through another filled with activated carbon. It has been established that fluorine content of 0.7 p.p.m. will cause definite dental defects in teeth of children. No practical method of removing fluorine has been found. In experiments conducted to determine effect of aquatic growths on tastes and odors, *Chara* gave the most trouble. Varying the water level seems to be a most effective form of control. In new method of applying copper sulfate, high-speed rotating disc is used to spread it. Ferric chloride floc, being of higher specific gravity than aluminum hydroxide, settles faster. Recent investigations show that water containing algae may react with *ortho*tolidine and cause false results in residual chlorine test. Synthetic resins prepared from certain phenols and tannins possess base-exchange properties. Aliphatic di- and triamines, added to strong acids, are excellent

corrosion inhibitors. Catalytic agents have appeared on the market for removal of iron and manganese. Influence of potential cross-connections in plumbing systems has caused considerable discussion. It has been predicted that, in water-borne epidemics of the future, pollution of water will be more likely to occur in distribution system than elsewhere.—*Lewis V. Carpenter.*

New England Cities Coöperate in Handling Flood Emergency. ROGER W. ESTY. Water Works Engineering, **89**: 11, 692, May 27, 1936. Describes the assistance given in New England during the flood by plants which were least affected to those which were less fortunate.—*Lewis V. Carpenter.*

Frost Penetration Story Revealed by a Group of Buried Thermometers. Anon. Water Works Engineering, **89**: 11, 739, May 27, 1936. Portland, Me., water department used buried thermometers to measure frost penetration. Readings showed that penetration is about 6 inches greater in sandy soil than in clay. During thaw, the deeper strata do not warm up as fast as the surface, so that freezing of services may sometimes occur while surface is thawing. Diagram is given showing location of thermometers and the various readings are assembled in a table.—*Lewis V. Carpenter.*

Some Practical Aspects of Handling Chlorine. CHRIS F. BINGHAM. Water Works and Sewerage, **83**: 2, 37–41, February, 1936. Article sets forth author's experience and recommendations in methods of handling chlorine. Kinds of pipe and tubing and their installation so as to prevent condensation are discussed. Temperature control and its effect on safety and on rate of gas withdrawal are considered. Methods for handling, storing, and ventilating cylinders are given. It is recommended that adequate number of gas masks be kept at hand and that following three rules be observed in using gas masks: (1) never use where there is any danger of oxygen deficiency: (2) life of canister is to be regarded as an unknown quantity; and (3) any gas mask job is a *two-man* job. Procedures in tracing and stopping leaks are discussed. Physical properties of chlorine are given.—*H. E. Hudson, Jr.*

Practical Problems in Water Distribution. E. W. BREITKREUTZ. Water Works and Sewerage, **83**: 2, 42, February, 1936. Presents experiences in the Los Angeles Water Bureau. Valve materials which give best service are discussed. All valves are inspected and operated at least twice yearly. Methods of insuring proper operation and continuous service of pressure reducing valves are given, chief of which is the use of recording flow-gages, to give continuous evidence of valve performance. Policies of Water Departments in relation to underground works of other utilities are critically reviewed. Special fittings which are useful in maintenance and in new construction are described. Double main system for certain installations, to prevent pavement cutting, is recommended.—*H. E. Hudson, Jr.*

General Conditions That Affect Profits in Water Works Operation. CHARLES H. CAPEN, JR. Water Works and Sewerage, **83**: 2, 46, February, 1936. This paper is a continuation of analysis of water works cost data accumulated by

the New Jersey Public Utility Commission. Tabulated data are given in the form of unit figures, and from these it is concluded that: (1) water systems operating at a low cost require greater ratios (*a*) of revenue to fixed capital, (*b*) of net income to fixed capital, and (*c*) of net income to revenue, than those operating at higher costs; (2) volume of output has no marked relation to the revenue:net income ratio, but tends to be inversely related to operating cost; (3) fixed capital is somewhat proportional to volume of output and has the same general irregularities; (4) geographical location has little effect on any of the ratios; and (5) of the companies studied, total revenue has advanced 17.8 percent while output has fallen 8.9 percent; a showing due mainly to some rate increases and mergers.—*H. E. Hudson Jr.*

On Operator Licensing, (A Letter). HAROLD R. TOWSE. Water Works and Sewerage, **83**: 2, 55, February, 1936. Author holds that education of operator-appointing officials would be ineffective and impracticable; that license laws will be better teachers than suasion; and points out that regulation of personnel admitted to practise medicine and law has been beneficial.—*H. E. Hudson, Jr.*

Dry Feeding Chemicals; Some Experiences at Norfolk, Va. R. W. FITZGERALD. Water Works and Sewerage, **83**: 2, 58–59, February, 1936. Due to dust troubles, Wallace and Tiernan dry feeders (of types now obsolete) were found unsatisfactory, while Omega machines proved serviceable. Recently added were two Syntron chemical feeders for feeding activated carbon. These provide accurate feed over wide range, namely, from one-half ounce to five tons per hour, and handle water works chemicals well. Author finds dry-feeding vastly superior to solution feed.—*H. E. Hudson, Jr.*

Air Conditioning in Relation to Water Consumption. LOGAN L. LEWIS. Water Works and Sewerage, **83**: 2, 61–63, February, 1936. General description of air-conditioning processes is given, followed by specific discussion of water use in air conditioning. Water use depends on water temperature; it is characterized by high peak demands, which sometimes reach 35 gallons per capita. Population data must be determined from capacity of air-conditioning equipment. This new demand may prove a serious problem to the water works man; in any event, it deserves his attention.—*H. E. Hudson, Jr.*

Calculating Efficiency in the Purchase of Pumping Equipment. A. M. BRENNEKE. Water Works and Sewerage, **83**: 2, 67, February, 1936. Describes method of calculating total cost of pump over a period of years, which intending purchasers will do well to consider. Example cited shows how saving of $1,000 in original investment may entail increase of $11,000 in operating costs over period of 10 years.—*H. E. Hudson, Jr.*

The Phosphate Method for Purification of Potable Water. E. A. NIKIFOROV and V. N. MEITINA. J. Applied Chem. U.S.S.R., **7**: 392–8, 1934. From Chem. Abst., **29**: 1910, March 20, 1935. Complete softening of magnesium-containing water with trisodium phosphate is impossible, because of solubility

of magnesium phosphate, limit of which corresponds to 10° (German) hardness. Complete softening can be attained only with mixture of trisodium phosphate, sodium carbonate, and sodium hydroxide in proportions varying with content of calcium and magnesium salts in water. By applying this mixture to Neva water (after coagulation), same residual hardness of 0.18 to 0.30° was attained as with permutite treatment. Interaction time was 15 minutes. Consumption of phosphate was 13 milligrams P_2O_5 per degree, or 30 milligrams per liter of water treated. Preliminary coagulation with alum (not more than 25 p.p.m. for Neva water) is essential for both permutite and phosphate treatments.—*R. E. Thompson.*

Purification of the Silver-Plated Sand Contaminated During the Filtration of Potable Water and Methods for the Improvement of Its Oligodynamic Action. S. V. Moiseev and N. S. Giller. J. Applied Chem. U.S.S.R., **7**: 205-12, 1934. From Chem. Abst., **29**: 1910, March 20, 1935. Sand silver-plated by method of Moiseev is best reconditioned by washing with cold water. Heating to 180° greatly improves activity of sand; repeated heating does not have any additional effect. Oligodynamic properties of spent silver-plated sand were restored and considerably improved as compared with original material by treatment for at least 30 minutes with hydrochloric acid. Twenty references.—*R. E. Thompson.*

Progress in the Conditioning of Water for Steam Boilers. R. E. Hall. Combustion, **6**: 5, 28–33, 1934. From Chem. Abst., **29**: 1911, March 20, 1935. Necessity for control of boiler-water alkalinity, prevention of feed-line scale, use of Magnaflux method in detecting cracks, prevention of corrosion due to small quantities of oxygen with sodium thiosulfate, and sodium aluminum silicate scales are discussed.—*R. E. Thompson.*

An Apparatus for Removing Bacteria and Color for Individual Water Supplies. H. O. Hettche. Gesundh.-Ing., **57**: 609–10. From Chem. Abst., **29**: 1911, March 20, 1935. Apparatus is in cylindrical drum. Upper portion contains 2 compartments, into one of which raw water is fed, the other containing solution of Caporite prepared by shaking 20 grams Caporite ($Ca(OCl)_2$) in 2 liters water, allowing to stand 2 days, and filtering. Solution is protected from carbon dioxide of air by covering with paraffin. Valves regulate flow from both compartments into vessel where mixing occurs. Overflow passes through successive layers of fine sand, activated carbon, and fine and coarse quartz sand treated with catadyn silver. Tests reported show efficient sterilization. —*R. E. Thompson.*

Dissolved Oxygen in Feed Water. David Brownlie. Steam Engr., **4**: 100–2, 130, 1934. From Chem. Abst., **29**: 1911, March 20, 1935. Winkler test, Admiralty Standard portable testing set, and Cambridge dissolved oxygen recorder are described.—*R. E. Thompson.*

Studies on the Longevity of Eberthella typhi in Sewage Sludge. C. C. Ruchhoft. Sewage Works J., **6**: 1054–67, 1934. From Chem. Abst., **29**: 1914,

March 20, 1935. In artificially infected sewage-activated-sludge mixtures, percentage surviving after various periods of aëration was slightly less for *E. typhi* than for colon-aërogenes group. After aëration for 5.5 hours, 14 percent remained. Settling, after 3-hour aëration period, removed practically no *E. typhi*, although large percentage of coli-aërogenes were removed. After aëration for 5.5 hours, 99.2 percent of *E. typhi* were removed by settling. Storage at 68–72°F. indicated that of 4 strains incubated, 1 died off very rapidly, 2 survived 8 to 10 days, and 4th (RAWLIN's) survived 13 to 14 days. At temperatures of 50–60°F., latter strain was isolated from sludge after 83 days. Conclusion: wet activated sludge cannot be considered innocuous and may be quite infectious.—*R. E. Thompson.*

Toxicity of the Coke-Oven Effluents Discharged into the Estuary of the River Tees. B. A. SOUTHGATE. Yearbook, Coke Oven Managers' Assoc., 1934, 203–13. From Chem. Abst., 29: 1915, March 20, 1935. Main poisonous substances discharged into estuary are tar acids (mainly in spent still liquors and, to much smaller extent, in effluents from coolers for coke ovens) and cyanide (almost entirely from cooler effluents). Latter is more toxic. Data given of tests on trout. Cyanides were converted to harmless ferrocyanides by agitation with ferrous chloride, available as spent pickle liquor. Hydrogen sulfide interfered because of precipitation of ferrous sulfide, which reacted slowly with cyanides. Aëration, or increase of alkalinity, increased rate. Cyanides were decreased by spraying liquor at 58° into air as fine mist, toxicity to trout being reduced to one-sixteenth of original value.—*R. E. Thompson.*

A New Process for Removing Phenol from Waste Waters. YA. I. CHULKOV. J. Chem. Ind. (Moscow) 1934, 12, 48–59. From Chem. Abst., 29: 2269, April 10, 1935. Solution of 10 grams per liter of phenol is treated with 40 grams per liter of sodium hydroxide, or equivalent of lime, and 30 grams per liter of chlorine passed in at 200 cc. per minute. Yield of 7 grams per liter of resin, which may be used in lacquers or paints or for new synthetic resin, stovilite, is obtained. Air is passed through solution to remove excess chlorine and liquid is treated with 0.5 to 2.0 percent of its weight of active carbon. Product is colorless, odorless, and phenol-free. Other impurities are also removed.—*R. E. Thompson.*

The Rapid Microdetermination of Phosphoric Acid in Potable Waters. GIULIO BUOGO. Industria chimica, 9: 1481–2, 1934. From Chem. Abst., 29: 2269, April 10, 1935. Colorimetric and nephelometric methods with ammonium molybdate and strychnomolybdate reagents (cf. ANTONIANI, C. A., 28: 6153, and BELLADEN, C. A. 28: 2083) have been applied to microdetermination of phosphate in water.—*R. E. Thompson.*

The Determination of Sulfates in Boiler Water. HELLMUT REICHELT. Chem.-Ztg., 58: 871–3, 1934. From Chem. Abst., 29: 2269, April 10, 1935. Several volumetric methods were compared as to precision and time required. Modification of palmitate titration method of BLACHER (C. A., 3: 2335) is recommended.—*R. E. Thompson.*

Scale in Steam Boilers. E. A. Smith. Steam Engr., **4**: 16–7, 150–1, 1934. From Chem. Abst., **29**: 2269, April 10, 1935. Increase in fuel consumption and decrease in thermal conductivity with increasing thickness of scale are shown graphically and discussed, together with theory of scale formation and of treatments for its prevention.—*R. E. Thompson.*

Determination of the Surface Tension of Water and Sewage. Karl Schultze. Arch. Hyg. Bakt., **112**: 48–61, 1934. From Chem. Abst., **29**: 2269, April 10, 1935. Active and passive surface tension determinations are used to measure contamination of water.—*R. E. Thompson.*

Critical Study of the Method for Determining the Hardness of Water. M. Lemarchands and Khoa Le Viet. Ann. chim. anal. chim. appl., **17**: 5–16, 1935. From Chem. Abst. **29**: 2268, April 10, 1935. Soap method was subjected to critical analysis, experiments being carried out with distilled water containing various inorganic salts and with natural waters. Details of improved technic are reserved for future paper.—*R. E. Thompson.*

A Simple Device for Supplying Hypochlorite Solution for Water Sterilization. Hayo Bruns and Pabst. Gas- ü. Wasserfach, **78**: 37–9, 1935. From Chem. Abst., **29**: 2268, April 10, 1935. Apparatus described for applying sodium hypochlorite.—*R. E. Thompson.*

Water Purification by Ozone. Theodore Rich. Engineering, **139**: 9–11, 1935. From Chem. Abst., **29**: 2268, April 10, 1935. Methods of preparing ozone and of its application for water purification at a number of plants are described.—*R. E. Thompson.*

Determination of Active Chlorine with a Combination Reagent. A. V. Yakovlev. Zavodskaya Lab., **3**: 900–3, 1934. From Chem. Abst., **29**: 2474, April 20, 1935. Following reagent was stored for about 6 months without any change and was used for determination of free iodine, active chlorine, and potassium permanganate with fairly accurate results. Triturate 0.5 gram starch with 20 cc. water and add to 100 cc. water containing 20 grams sodium chloride. Boil, filter, add to solution 5 grams potassium iodide, 3.5 grams potassium hydroxide in 40 cc. water, 20 cc. 50 percent acetic acid, and 10 cc. 0.1 normal sodium thiosulfate and filter. Make exactly 0.01 normal in thiosulfate and preserve in dark-colored bottle.—*R. E. Thompson.*

The Improvement of Drainage and Water Pipes by the Use of Lead Alloys. Kenneth Gray. Munic. Eng. Sanit. Record, **95**: 105–7, 1935. From Chem. Abst., **29**: 2493, April 20, 1935. Lead pipes laid about first century A.D. to bring water to Roman baths at Chester were remarkably well preserved after nearly 2000 years underground. Modern pipes sometimes fail after but few years. Purity of old pipe, determined spectroscopically was no greater than that of good commercial lead now available. Weak acids produce sort of intercrystalline cracking or penetration in modern pipe. Scouring lines in extruded pipe due to die and core are considered to be starting points for

corrosion. Oxide inclusions from skin on bath of extruding machine also cause corrosion. Old Roman pipe was cast. Use of alloying constituents to improve corrosion resistance discussed.—*R. E. Thompson.*

Estimation of Lead in Drinking Water. KARL HÖLL. Apoth. Ztg., **50**: 126–8, 1935. From Chem. Abst., **29**: 2635, April 20, 1935. Summary of more dependable methods of estimating minute amounts of lead (0.1 to 30 p.p.m.) in water. Fourteen references.—*R. E. Thompson.*

Corrosion Tests on a Galvanized Iron. A. L. SAVVATEEV. Trans. State Inst. Applied Chem. (U.S.S.R.), No. 21: 67–9, 1934. From Chem. Abst., **29**: 2495, April 20, 1935. Iron plates, galvanized under various conditions, were placed in water saturated with oxygen, and time of appearance of corrosion noted. With zinc coatings of 0.0044 gram, or more, per square centimeter, rust appeared after 5 days. With lighter coatings (0.0012 gram), resistance to corrosion depended on method of electrolytic deposition, being greater for coatings deposited slowly and at low current density.—*R. E. Thompson.*

The Bactericidal Action of Some Colloidal Solutions and Their Hygienic Significance. MILAN PRICA. Z. Hyg. Infektionskrankh., **116**: 385–96, 1934. From Chem. Abst., **29**: 2569, April 20, 1935. Colloidal silica, ferric hydroxide, and alumina exercised bactericidal action on *Es. coli* and other organisms. Application of observations to water purification is discussed.—*R. E. Thompson.*

The Voges-Proskauer Reaction. S. S. EPSTEIN and MAX LEVINE. Proc. Iowa Acad. Sci., **40**: 80, 1933; cf. C. A., **28**: 4097. From Chem. Abst., **29**: 2569, April 20, 1935. Formation of acetylmethylcarbinol by members of genus Aërobacter was detected in 6-hour cultures. Procedure involved heavy inoculation of young agar slant cultures into approximately 3 cc. Difco M. R.-V. P. medium, incubation at 30° for 6 hours, and use of 0.3 per cent creatine in 40 percent potassium hydroxide as test reagent. Seventy percent of 202 cultures tested produced positive results within 1 hour after addition of test reagent and over 99 percent within 4 hours. Creatine-potassium hydroxide solution was satisfactorily effective for 3 weeks, when kept under ordinary laboratory conditions, and for 6 weeks, when stored at ice-box temperatures. In comparing various modifications with standard procedure it was found that: (1) in instances where organisms produced strong and rapid reactions, there was little evidence of any advantage of modifications over "Standard Method"; and (2) in instances where reaction was weak when 10 percent potassium hydroxide was used, some of special reagents were of material influence in accelerating color reaction: among these were creatinine (O'MEARA, C. A., **25**: 5188), ferric chloride (WERKMAN, C. A., **24**: 5051), and copper-ammoniacal sodium hydroxide solution (LEIFSON, C. A., **26**: 5981): creatinine with 40 percent potassium hydroxide gave best results.—*R. E. Thompson.*

The Oligodynamic Purification of Drinking Water by Means of Different "Katadyn" Methods. H. GUTSCHMIDT. Z. Hyg. Infektionskrankh., **116**:

421–32, 1934. From Chem. Abst., **29**: 2633, April 20, 1935. Oligodynamic action of silver by "katadyn" methods is satisfactory for disinfection of drinking water. As indicator of this action, strains of *Es. coli* are satisfactory, but variable. For clear waters free from gross contamination, flask, filter, and electro "katadyn" methods are practicable; for heavily contaminated waters, first two can be used, but third, only in conjunction with filtration.—*R. E. Thompson.*

Determination of Fluorine in Potable Waters. JUAN M. MUÑOS. Rev. soc. argentina biol., **10**: 395–8, 1934; cf. C. A., **28**: 5874. From Chem. Abst., **29**: 2634, April 20, 1935. Results previously reported were obtained by method of CASARES. More recent determinations by method of SANCHIS (C. A., **28**: 2813) have given lower values in many cases. In samples containing 1 p.p.m., or less, of fluorine and about 100 times as much sodium sulfate, former method may give values 2 or 3 times as high as latter. In samples containing 2 to 15 p.p.m. fluorine and no excessive amounts of sulfate, the two methods agree fairly well.—*R. E. Thompson.*

Conditioning of a Chloramine-Treated Water Supply for Biological Purposes. F. L. COVENTRY, V. E. SHELFORD and L. F. MILLER. Ecology, **16**: 60–66, 1935. From Chem. Abst., **29**: 2634, April 20, 1935. Treatment with sodium thiosulfate, hydrogen sulfide, ferrous salts, or ethylene proved effective for removal of chloramine; but rigorous control is required in each case. Filtration through activated carbon was found most satisfactory. Dissolved oxygen, which is also removed, is replaced by subsequent aëration.—*R. E. Thompson.*

Determination of pH in Natural Waters. YU. I. USATENKO. Zavodskaya Lab., **3**: 946–8, 1934. From Chem. Abst., **29**: 2633, April 20, 1935. Tentative discussion with mathematical treatment of determination of pH on basis of bicarbonates and carbon dioxide in solution.—*R. E. Thompson.*

Saturnism Due to Drinking Water (Its Great Frequency in Regions Poor in Lime); Diagnosis. R. PICARD. Rev. med., **51**: 133–45, 1934. From Chem. Abst., **29**: 2635, April 20, 1935. Diagnosis must be supplemented by analysis of drinking water.—*R. E. Thompson.*

The Occurrence of Mottled Enamel in Iowa. CARL T. OSTREM, D. A. GREENWOOD, H. A. WILLHELM and VICTOR E. NELSON. Proc. Iowa Acad. Sci., **40**: 99–102, 1933; cf. C. A., **29**: 1547. From Chem. Abst., **29**: 2635, April 20, 1935. Mottling of teeth in certain locality in Iowa is due to excessive fluorides in water. Analyses of waters from various sections of state are being made. Cause of mottling has been verified by experiments on rats.—*R. E. Thompson.*

Identification of Bacteria in Water. F. DIÉNERT, P. ÉTRILLARD and Mme. M. LAMBERT. Compt. rend., **199**: 102–4, 1934. From Chem. Abst., **29**: 2635, April 20, 1935. Suspected water (5 liters) containing $Al(OH)_3 \cdot H_2O$ (25 cc.)

is left for 12 hours at 0°. Adsorbed bacteria are eluted with 1 percent disodium phosphate at pH 8.4, incubated at 37° for 48 hours in 10 per cent peptone solution at pH 7.5, and identified in usual way.—*R. E. Thompson.*

Mechanically Wrapped and Coated Pipe Helps Fight Against Corroson. ANDREW M. ROWLEY. Oil and Gas J., **33**: 38, 30–1, 1935. From Chem. Abst., **29**: 2896, May 10, 1935.—*R. E. Thompson.*

The Occurrence of Aërobacter Aërogenes in Sewage and Feces. N. ATKINSON. Austalian J. Exptl. Biol. Med. Sci., **12**: 141–9, 1934. From Chem. Abst., **29**:2636, April 20, 1935. Crude sewage, effluent, and feces contained *A. aërogenes* regularly, in ratio of about 1:20 to lactose fermenters. Death rate was about same as that of *Es. coli*. Author suggests that for index of pollution requirements, differentiation is not necessary.—*R. E. Thompson.*

Prevention of Crusting on Boiler Safety Plugs. H. N. BASSETT. Mech. World, **95**: 275–6, 1934; Met. Abstracts (in Metals and Alloys) **5**: 538. From Chem. Abst., **29**: 2891, May 10, 1935. Common causes of failure of safety plugs are formation of scale and "picking up" of copper, both of which raise melting point. Analyses of different scales are tabulated and discussed. It is advisable to use bronze containing as little zinc as possible for body of plug, so as to avoid absorption of zinc by tin filling. Absorption of copper is important; copper up to 1 percent reduces melting point of tin filling; but any in excess of this amount causes considerable rise in melting point. It is therefore necessary to pour at as low temperature as possible. Bores of plugs should be well tinned before filling.—*R. E. Thompson.*

Electrolytic Zinc Tubes for Piping Water and Gas. L. DESCROIX. Génie civil, **105**: 380–2, 1934; cf. C. A., **28**: 7229. From Chem. Abst., **29**: 2896, May 10, 1935. Zinc, 99.95–99.99 percent pure, is drawn at 150–200°. Above 200°, zinc becomes crystalline; below 150°, it is not sufficiently malleable. Pipes have high polish both inside and outside, and can be plated with nickel or copper. They combine advantages of steel tubes and lead pipes, have unusual resistance to internal pressure, and empty faster than iron pipes. Description of process at Viviez is given.—*R. E. Thompson.*

Vulcanized Rubber is Applied to Pipe Line to Combat Corrosion. L. E. BREDBERG. Oil and Gas. J., **33**: 38, 14, 1935. From Chem. Abst., **29**: 2896, May 10, 1935.—*R. E. Thompson.*

Cathodic Protection of Pipe Lines from Soil Corrosion. SCOTT EWING. Natural Gas, **16**: 3, 5–10, 1935. From Chem. Abst., **29**: 2896, May 10, 1935. Cathodic protection is defined as use of external electric current to maintain submerged or underground metallic structures at negative potential toward surrounding electrolyte. Use of rectifiers to apply direct-current voltage is described for various successful installations on coated pipe. Anode is usually several lengths of scrap pipe which serves to protect much larger lengths of service pipe. Data necessary for calculation of rectifier capacity,

type of coating required, and location of ground, rectifier, and drain points are discussed.—*R. E. Thompson.*

Building a Model and Experimental Water Treatment Plant. E. F. ELDRIDGE and F. R. THEROUX. Mich. Eng. Expt. Sta., Bull. No. 60: 61–4, 1934. From Chem. Abst., 29: 3076, May 10, 1935. Classroom demonstration and laboratory-scale experimental set-up described.—*R. E. Thompson.*

Turbulence as an Aid in Water Purification. KURT SAFRANEZ. Gas- u. Wasserfach, 78: 93–8, 1935. From Chem. Abst., 29: 3077, May 10, 1935. Good mixing of chemicals with water can be effected by turbulence, induced by changes in direction of flow. Construction of equipment suitable for this purpose is discussed and dimensions are given.—*R. E. Thompson.*

Determination of the Impurities which are Superficially Active in Water. KARL SCHULTZE. Z. anal. Chem., 100: 6–20, 1935. From Chem. Abst., 29: 3077, May 10, 1935. With aid of torsion balance, superficially active impurities, especially oil, can be collected in capillary, and from surface tension measurement, concentration of impurities can be calculated.—*R. E. Thompson.*

Sodium Phosphates and the Protection of Boilers Against Scale. LOUIS GERMAIN. Chimie industrie, 33: 3–19, 1935; cf. C. A., 28: 6949. From Chem. Abst., 29: 3077, May 10, 1935. Principle of boiler water purification by continuous blow-down methods is outlined and reactions involved in each stage thereof are studied qualitatively and quantitatively; relations between composition of raw water, manner of carrying out treatment, and theoretical consumption of phosphates are brought out. In continuous blow-down, with trisodium phosphate as sole purifying chemical, consumption of reagent is appreciably higher than theoretical. This anomaly is due to adsorbing power of tricalcium phosphate, considerable quantities of sodium hydroxide, sodium carbonate, and trisodium phosphate being thus discharged from boiler and purifying tank with sludge; on the other hand, adsorption of neutral salts by sludge permits of eliminating almost completely losses of blow-down to sewer. The various methods are discussed from standpoint of cost. Scale-removing properties of trisodium phosphate are due to adsorbing power of precipitated phosphate toward soluble alkaline earth salts.—*R. E. Thompson.*

The Iodine Content of Some Polish Waters. STANISLAW KRAUZE. Wiadomości Farm., 62: 85–8, 101–4, 1935. From Chem. Abst., 29: 3077, May 10, 1935. Iodine content of potable waters in Poland varies from 1.1 to 12.4γ per liter. Statistics show no relation between iodine content of water and occurrence of goiter.—*R. E. Thompson.*

Fluorides in Kansas Waters and Their Relation to Mottled Enamel. SELMA GOTTLIEB. Trans. Kansas Acad. Sci., 37: 129–31, 1934; cf. C. A., 28: 6499. From Chem. Abst., 29: 3077, May 10, 1935.—*R. E. Thompson.*

Hygienic Risks in Infected Water and Infected Natural and Artificial Ice. MAX GRÜNEWALD. Pharm. Zentralhalle, 76: 86–9, 1935. From Chem. Abst.,

29: 3079, May 10, 1935. Risks discussed in connection with authentic cases of epidemics involving typhoid, paratyphoid, diphtheria, scarlet fever, cholera, and other intestinal disorders.—*R. E. Thompson.*

So-Called Sewage Poisoning in Cattle. F. C. MINETT, G. H. WOOLDRIDGE and A. L. SHEATHER. Veterinary Rec., 14: 147–55, 1934. From Chem. Abst., 29: 3078, May 10, 1935. During period of 21 months, Ayrshire cattle were allowed to consume water containing human sewage. In one case, a milking cow consumed 5146 gallons of sewage and for 11 months the animal drank nothing but undiluted sewage effluent; cow gave birth to healthy calf and produced normal yield of milk. Animals gave no indication that fluid was distasteful to them; they thrived normally and maintained, or increased, their weight. Conclusion is that symptoms shown by cattle in alleged cases of sewage poisoning may be due to other causes.—*R. E. Thompson.*

Sewage: Is It a Source of Poisoning in Animals? I. The Clinical Aspect. L. P. PUGH. Veterinary Rec., 14: 155–6, 1934. **II. The Bacteriological Aspect.** A. W. STABLEFORTH. Ibid., 156–9. There is no evidence of presence in sewage of specifically harmful bacteria. **III. The Chemical Aspect.** G. D. LANDER. Ibid., 159–61. As yet, no poisonous compounds have been found in sewage.—*R. E. Thompson.*

Phenolic Wastes. Report No. 1. E. F. ELDRIDGE. Mich. Eng. Expt. Sta., Bull. No. 60: 49–60, 1934. From Chem. Abst., 29: 3079, May 10, 1935. Author presents preliminary experimental results and extensive literature survey with 42 references. Phenol contents of 7 typical industrial wastes vary from 0.061 gram per liter for wood-distillation plant to 3.838 grams per liter for pentane extraction plant. Preliminary studies of toxicity threshold for fish indicate that 20–25 p.p.m. pure phenol in aerated sample, and 10–20 p.p.m. in non-aerated, will kill. For cresol, threshold value was 15–20 p.p.m. for both aerated and non-aerated samples. Experiments on removal with activated carbon are in progress.—*R. E. Thompson.*

Determination of Lead in Drinking Water. B. WILLBERG. Z. Untersuch. Lebensm., 69: 85–7, 1935. From Chem. Abst., 29: 3434, May 20, 1935. Modification of WINKLER colorimetric method described.—*R. E. Thompson.*

Corrosion of Copper. L. W. HAASE. Metallwirtschaft, 14: 32–3, 1935. From Chem. Abst., 29: 3285, May 20, 1935. Copper used for hot- and cold-water lines, hot-water heaters and similar purposes is liable to develop pin-hole defects unless water is sufficiently pure. If water contains oxygen and ferric oxide, local elements form, which cause corrosion. It was found that 0.3 p.p.m. iron was enough to cause pin-hole formation. Another type of corrosion is caused by water-air line. This can usually be corrected by proper design of installation.—*R. E. Thompson.*

Supervision of Potable Water Supplies on Liners. R. MAHE. Ann. Hyg., 12: 313, 1934. From Chem. Abst., 29: 3431, May 20, 1935. If pathogenic organisms are found in water supply, Javelle water, potassium permanganate,

or other suitable germicide, should be applied at selected points in distribution system. Dosage of permanganate should give color persisting for at least 20 minutes in 1-liter test sample; contact period of 2 hours is necessary, and color may be removed with sodium thiosulfate. Possible sources of contamination and cleaning of hose pipes and tanks are discussed. No epidemics of water-borne typhoid, or dysentery, have been reported on trans-Atlantic liners. Disinfection of water with ozone or ultra-violet rays is suggested. Apparatus treating 1 cubic meter per hour would be adequate for liner carrying 500 persons.—*R. E. Thompson.*

Estimation of Chlorine in Water by the *o*-Tolidine Method. S. D. SUNAWALA and K. R. KRISHNASWAMI. J. Indian Inst. Sci., **17A**: 141–51, 1934. From Chem. Abst., **29**: 3433, May 20, 1935. Experiments show that yellow color develops slowly in dilute solutions. Appreciable time is required to attain maximum intensity and color then fades slowly; rate of reaction depends upon temperature in both cases. Most suitable time for making color comparison is after between 10 and 25 minutes at 30° and after between 30 and 45 minutes at 20°. Ferric chloride causes high results if more than 0.3 p.p.m. iron is present. Nitrites also interfere.—*R. E. Thompson.*

Determination of Free Carbon Dioxide in Humus-Containing Waters. YRJÖ KAUKO. Ann. Acad. Sci. Fennicae, **A39**: 2, 27 pp., 1934. From Chem. Abst., **29**: 3434, May 20, 1935. Decomposition curves for saturated solutions of carbon dioxide and calcium bicarbonate were determined at 28°, 15°, and 0° by use of specially designed stirrer operating at 6000 r.p.m. in container through which carbon dioxide-free air was passed at different rates. Data are summarized in tables and graphs. Velocity of decomposition of both solutions varies considerably with temperature when optimum amount of air is passed through. Method for determining free carbon dioxide is derived from fact that major part of free carbon dioxide is evolved before carbon dioxide from bicarbonate starts to come off.—*R. E. Thompson.*

Periodic Analyses of a Mineral Water, and (the Growth of) Spirogyra Borgeana Transeau. R. RETOVSKY. Bull. soc. chim. biol., **17**: 96–105, 1935. From Chem. Abst., **29**: 3437, May 20, 1935. Water of spring rich in bicarbonates loses carbon dioxide rapidly, pH increasing from 6.2 to 7.2 soon after issue from ground. *Spirogyra borgeana* growing in water in open remained asexual. When grown in closed glass jar of the water charged with carbon dioxide under pressure, copulation took place and zygospores were formed.—*R. E. Thompson.*

Bacterial Purification Rates in Polluted Water. J. K. HOSKINS. Am. J. Hyg., **21**: 280–301, 1935. From Chem. Abst., **29**: 3438, May 20, 1935. Experiments conducted on polluted water in naturally flowing rivers, laboratory containers, and artificially constructed streams showed that reduction of bacteria was essentially due to destruction by plankton. Under conditions such as prevail in shallow streams and sewage trickling filters, where polluted water came into intimate contact with well-developed growth of plankton, bacteria decreased most rapidly.—*R. E. Thompson.*

Recent Innovations in the Manufacture of Asbestos Cement. E. LECHNER. Cement and Cement Manuf., 7: 178–82, 1934. From Chem. Abst., 29: 3483, May 20, 1935. Manufacture of asbestos-cement pipe, etc., described.—*R. E. Thompson.*

Automatic Apparatus for Treating a Flowing Liquid with a Predetermined Proportion of à Reagent. Comp. pour la fabrication des compteurs et matérial d'usines à gaz. Ger. 610, 316, Mar. 8, 1935 (Cl. 12f. 4). From Chem. Abst., 29: 3559, June 10, 1935. Apparatus may be used for treating water with sodium hypochlorite. Cf. C. A., 28: 2448.—*R. E. Thompson.*

Quantitative Spectrographic Analysis of Alkali Metals. Application to Cesium in Mineral Waters. ROBERT BOSSUET. Compt. rend., 200: 1094–6, 1935; cf. C. A., 28: 5724. From Chem. Abst., 29: 3623, June 10, 1935. Emission spectra, obtained on volatilizing in oxygen-acetylene flame 0.025 cc. of solutions of decreasing concentration until *raies ultimes* are no longer visible, are photographed and compared with similarly obtained spectra of solutions of known composition. Method is specially applicable to alkali metals, and has shown cesium chloride contents in 10 French mineral waters, varying from 0.12 to 2.0 p.p.m.—*R. E. Thompson.*

The Application of the Photoelectric Cell in the Analysis of Natural Waters. N. N. ANDREEV and E. V. ANDREEVA. J. Gen. Chem. (U.S.S.R.), 4: 594–7, 1934. From Chem. Abst., 29: 3755, June 10, 1935. Precipitants are added to samples of water and turbidity measured with photoelectric photometer. Dilutions required for constant results are determined by experiment in each case and photometer is calibrated for various determinations by chemical analyses. Examples of procedure and methods of calculation are given for determination of chlorine with silver nitrate, of carbonate and bicarbonate by reaction with alum to give colloidal alumina, of sulfate with barium chloride, and of magnesium [?] and calcium by precipitation as oxalate.—*R. E. Thompson.*

Water Softening by the Permutite Process; the Hygienic Aspect of Domestic Use of Softened Water. H. F. KUISEL. Schweiz. Ver. Gas-Wasserfach. Monats-Bull., 15: 37–43, 1935. From Chem. Abst., 29: 3755, June 10, 1935. Review of hygiene, economy, and chemistry of domestic permutite water softeners with sodium chloride regeneration. Comparative tests showed that "Webbolite" was most efficient. Graphs are given showing changes of hardness, pH, chloride, and aluminum content as functions of amount of water purified, for 4 species of permutite. It is concluded that pH change and softening do not run parallel; trend is specific for each permutite species. Chloride content decreases to that of raw water after passage of definite quantity of water; initial aluminum content of softened water is double the final value (0.01 and 0.005 milligram per 100 cc., respectively). For some permutites, *e.g.*, Natrolith, efficiency at first increases after each regeneration. Problem remains to prepare water of constant 3–4° (Fench) hardness value. High initial pH (11.5) of permutite-treated water gives it an unpleasant alkaline taste.—*R. E. Thompson.*

Occurrence and Destruction of Small Forms of Animal Life in Water Works. F. BOETTCHER. Gas- u. Wasserfach., 78: 176–72, 1935. From Chem. Abst., 29: 3756, June 10, 1935. While numerous small forms of animal life that may occur in filters, aëration plants, and other water works containers are rarely of sanitary significance, they may be most disagreeable to consumers. Insects and certain forms of water animals may be destroyed by dusting with pyrethrum powder. Use of ammonia gas is also recommended for closed vessels as least apt to disturb filter operation.—*R. E. Thompson.*

Lactose-Fermenting Organisms Encountered in the Bacteriological Analysis of Water in the Tropics. G. MACKEY. Indian Med. Gaz., 70: 140–3, 1935. From Chem. Abst., 29: 3756, June 10, 1935. To simplify examination in tropics, single table is proposed to include the 25 most commonly encountered organisms.—*R. E. Thompson.*

The Efficiency of Surface Treatments for Decreasing the Permeability of Concrete. G. W. WASHA. J. Am. Concrete Inst., 5: 1, 1–8, 1933; Expt. Sta. Record, 70: 542–3. From Chem. Abst., 29: 3801, June 10, 1935. Treatments were divided into 7 classes: (1) water solutions of inorganic salts which react chemically with constituents in concrete with deposition of insoluble material in pores; (2) water suspensions of substances, or mixtures of substances, which are of pore-filling character or react chemically with each other, or with constituents in concrete, and form pore-filling compounds; (3) soaps; (4) combinations which react chemically with each other in pores of concrete and fill them with substances of water-repellent or insoluble nature; (5) solutions of liquid and solid hydrocarbons consisting of heavy petroleum distillates, such as lubricating oil or paraffin, dissolved in volatile solvents such as gasoline; (6) bituminous coatings and membranous systems which tend to produce films or membranes over surface of concrete; and (7) miscellaneous washes and cement groups. Treatments were more or less beneficial in all cases, efficiencies varying from 40 to 90 percent. Some of more effective treatments are: (*a*) 1:1 grout properly cured, (*b*) Minwax, (*c*) 1:2 grout properly cured, (*d*) neat cement properly cured, (*e*) plain asphalt emulsion, (*f*) Glidden, (*g*) Sika grouts, (*h*) Por-seal "A", (*i*) casein, and (*j*) sodium silicate. Rate of leakage through specimen for 20- to 50-hour period is practically same as rate for 40- to 50-hour period. If cement grouts are used, they should be moist-cured for at least 1 week. Efficiency of 1:1 grout was reduced from 88 to 45 percent by decreasing moist-curing period from 7 to 0 days. The 1:1 grout cured 7 days gave efficiency of 88 percent, highest of any grout tested. With 1:2 grout, efficiency was 72 and with neat cement 65 percent. Exposure to elements decreased efficiency of all treatments tested with exception of sodium sulfate + barium chloride. Decrease in efficiency caused by exposure of 2 years varied from 5 to 80 percent of original value. One treatment, however, increased in efficiency about 70 percent.—*R. E. Thompson.*

Determination and Quantity of Boron in Sea Water. MAYNARD W. HARDING and ERIK G. MOBERG. Proc. 5th Pacific Sci. Congr., 3: 2093–5, 1934. From Chem. Abst., 29: 3883, June 20, 1935. Method for titration of boron in

sea water in presence of mannitol is given. Boron content ranged from 4.3 to 4.8 milligrams per kilogram of sea water.—*R. E. Thompson.*

Gravimetric Determination of Calcium and Magnesium. A. M. VASIL'EV and L. A. VASIL'EVA. Trans. Kirov Inst. Chem. Tech. Kazan, **3**: 67–72, 1935; cf. C. A., **28**: 4679. From Chem. Abst., **29**: 3935, June 20, 1935. Experiments indicate that appreciable quantities of calcium oxalate are dissolved by washing with hot water, for which dilute ammonium oxalate should be substituted, and that washing magnesium ammonium phosphate with dilute ammonium hydroxide causes losses which can be avoided by washing with saturated solution of magnesium ammonium phosphate.—*R. E. Thompson.*

The Determination of Calcium by Weighing as Calcium Oxalate. HELENA SIBELIUS. Suomen Kemistilehti, **8A**; 25–7, 1935. From Chem. Abst., **29**: 3935, June 20, 1935. Washing precipitate with alcohol and ether and weighing as $CaC_2O_4 \cdot H_2O$ is again recommended.—*R. E. Thompson.*

The Spectrographic Detection of Cesium, Rubidium, and Potassium, Especially in Mineral Waters. VITTORIO GAZZI. Ann. chim. applicata, **24**: 595–612, 1934. From Chem. Abst., **29**: 3935, June 20, 1935. Cesium, rubidium, and potassium can be detected by utilizing infra-red lines: 8521 for cesium, 7947 and 7800 for rubidium, and 7699 and 7695 A. for potassium. Spark, flame, and arc spectra were investigated; they are increasingly sensitive in this order. Flame spectrum is simplest to apply and will detect 0.03, 0.01, and 0.1 milligram/cc., while arc spectrum will detect 0.009, 0.002, and 0.002 milligram/cc. of cesium, rubidium, and potassium, respectively. Method can be used in examination of mineral waters.—*R. E. Thompson.*

Corrosion and Other Forms of Destruction of Pipe Material in Underground Construction. C. ABWESER. Korrosion u. Metallschutz, **11**: 59–64, 1935. From Chem. Abst., **29**: 3969, June 20, 1935. Protective coatings and other remedies against destruction, especially by stray currents, frost, and mechanical influences, are discussed.—*R. E. Thompson.*

The Bactericidal Action of Ultraviolet Light. B. LLOYD. J. Roy. Tech. Coll., **3**: 505–11, 1935. From Chem. Abst., **29**: 4041, June 20, 1935. Exposure of filtered sea water to ultraviolet radiation for 1 second sterilizes it very effectively, killing native organisms as well as *Es. coli.*—*R. E. Thompson.*

The Solubility of Gases in Water. HUGO HERMANN. Wärme, **57**: 615–17, 1934. From Chem. Abst., **29**: 4109, June 20, 1935. Equations are set up by means of HENRY'S and DALTON'S laws for oxygen and carbon dioxide in boiler water. Their use in de-aerating methods and temporary hardness removal in boiler water treatment are discussed.—*R. E. Thompson.*

The Removal of Fluorine from Drinking Waters in the State of Iowa. C. A. KEMP, D. A. GREENWOOD and V. E. NELSON. Proc. Iowa Acad. Sci., **41**: 153–6, 1934. From Chem. Abst., **29**: 4109, June 20, 1935. Fluorine content may be

considerably reduced by alum treatment as suggested by BORUFF (C. A., 27: 4861). The pH value is a factor.—*R. E. Thompson.*

System $CaCO_3$-$CaSO_4$-H_2O at 159° to 252°, and the Effect of Additions of Sodium Salts. L. M. CLARK and E. HUNTER. J. Chem. Soc., 1935, 383-91. From Chem. Abst., 29: 4111, June 20, 1935. To discover conditions for minimizing formation of boiler scale, equilibrium ratio CO_3/SO_4 was determined in system $CaCO_3$-$CaSO_4$-H_2O. Values above 230° are lower than those calculated previously and temperature coefficient is smaller. When sodium sulfate is added, the CO_3/SO_4 ratio is greatly reduced. Effect of sodium chloride is much less. Lowering of ratio by sodium hydroxide is partly due to sodium sulfate formed and partly to sodium hydroxide itself.—*R. E. Thompson.*

Colorimetric Determination of Aluminum in Waters. M. A. SHPAK and SHUBAEV. Iskusstvennoe Volokno (Artificial Fiber), 6: 1, 51–2, 1935. From Chem. Abst., 29: 4109, June 20, 1935. HATFIELD colorimetric method for determination of aluminum in water gives consistently low results, because in industrial waters part of aluminum (even at concentration of 1 p.p.m.) is contained in weighable form (probably as aluminum hydroxide). Uniformly accurate results are obtained by following modification: Place 25 cc. sample in graduated cylinder, pipet into number of similar cylinders 0.2, 0.3, 0.4, etc., cc. standard solution of $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4$ (0.1 gram/liter Al_2O_3), pour into all cylinders 10 cc. 0.1 normal sulfuric acid, shake, add 10 cc. normal sodium hydroxide and 50 cc. water, shake, dilute to definite volume, add exactly 1 cc. saturated ammonium carbonate and 1 cc. 1 percent hematoxylin solution, allow to stand 15 minutes, add 1 cc. 30 percent acetic acid, shake, and compare with standards. Standard most nearly resembling sample is then used for Dubosc colorimetric determination.—*R. E. Thompson.*

Effect of Chlorination on Water Organism. A. O. TAUSON. Bull. inst. récherches biol. univ. Perm., 9: 251–63 (in German, 263–9), 1934. From Chem. Abst., 29: 4111, June 20, 1935. Samples containing *Daphnia longispina* var. *longispina*, *Ceriodaphnia pulchella*, *Cyclops leuckarti*, *Volvox aureus*, *Pandorina morum*, *Eudorina elegans*, *Aphanizomenon flos aquae*, and *Anabaena spiroides* were prepared and chlorinated. It was found that residual chlorine in excess of 0.2 p.p.m. at temperature of 21° was fatal to most of above organisms in about 2 hours. Daphnia and Ceriodaphnia were dead in 2 hours and 40 minutes at this dosage, and in 1 hour and 45 minutes at residual of 0.25. Investigation shows that dose of 1.25 p.p.m. chlorine is sufficient for all plankton organisms except Cyclops, and that contact of about 2 hours should be allowed before water is considered safe for drinking. Complete tables given. —*R. E. Thompson.*

The Treatment of Boiler Feed Water with Trisodium Phosphate in the Recent Literature, with Special Reference to the Budenheim Process. PAUL KOPPEL. Wärme, 57: 630–3, 644–7, 1934. From Chem. Abst., 29: 4110, June 20, 1935. Budenheim process is carried out in 3 stages, i.e., thermal, alkaline pretreatment, and trisodium phosphate. In thermal stage, cascade pre-warmer heats

water with countercurrent steam under violent mechanical agitation for removing oxygen and carbon dioxide and precipitating bicarbonates. Alkaline pretreatment stage proceeds with returned boiler water to which caustic has been added; this fixes as sodium carbonate last traces of carbon dioxide. Trisodium phosphate removes all trace of dissolved calcium carbonate by precipitation as calcium phosphate. Tables are given showing effectiveness of treatment for number of difficult boiler waters. Criticisms of process in German literature are presented and answered.—*R. E. Thompson.*

The Practice of Scale Removal from Boilers and the Purification of Supply Water by Trisodium Phosphate. P. VERTES. Industrie chimique, **21**: 886–9, 1934. From Chem. Abst., **29**: 4110. Rapid removal of scale from boiler tubes can be effected by contact with trisodium phosphate solution, 2 kilograms per cubic meter. Decrease in phosphate concentration indicates dissolving of scale. Phosphate concentration is maintained at original value by further additions. When concentration ceases to diminish, reaction is considered complete. Tubes are opened and brushed out to remove calcium phosphate mud. From 2 to 5 days are required for cleaning. Slower process, requiring 2 weeks to 3 months, suitable for boilers containing scale not exceeding 3 millimeters in thickness, involves use of feed water containing excess phosphate. Phosphate concentration of 500 grams per cubic meter may be used for short intervals without experiencing too high alkalinity. Concentration should remain at approximately 100 grams Na_3PO_4 per cubic meter. Precipitation of lime salts usually occurs before boiler is reached. For certain waters it is permissible to allow precipitation by phosphate within boiler. One hundred grams $Na_3PO_4 \cdot 12H_2O$ in excess, per cubic meter feed water, maintains pH of 9 to 9.5, without caustic alkalinity. Basic calcium phosphate, $Ca_3(PO_4)_2 \cdot Ca(OH)_2$, may be formed in either neutral or alkaline solution. The OH^- for this precipitation may be furnished by water, calcium hydroxide, or sodium hydroxide. Recommended temperature for phosphate treatment is 75° to 85°.—*R. E. Thompson.*

Boiler-Steel Embrittlement. A Critical Summary of Published Information. EVERETT P. PARTRIDGE and W. C. SCHROEDER. Mech. Eng., **57**: 294–6, 1935. From Chem. Abst., **29**: 4111, June 20, 1935.—*R. E. Thompson.*

Stream Pollution and Textile Wastes. C. D. BLACKWELDER. Textile-Bull., **48**: 7, 8–9, 1935. From Chem. Abst., **29**: 4114, June 20, 1935. Discussion of water pollution by wastes from textile plants and of methods of treatment and disposal of wastes. Cost of disposal plants and chemical costs for operation vary greatly with capacity of plant, character of wastes, dilution factor of receiving stream, and local conditions. Initial plant cost varies from $35 to $400 per 1000-gallon capacity per 24 hours. Chemical cost varies from 0.25 to 75 cents per 1000 gallons treated. Also in Am. Dyestuff Reptr., **24**: 259–61, 1935.—*R. E. Thompson.*

Principles of Siphon Design for Colorado River Aqueduct. D. B. GUMENSKY. Eng. News-Rec., **114**: 899–903, June 27, 1935. Inverted siphons in 242.3-mile

Colorado River aqueduct of Metropolitan Water District of Southern California, which will number 146, will aggregate 28.9 miles, or 11.9 percent of total length. Siphons traverse terrain varying topographically from steep mountain gorges to broad valleys, and ground conditions vary from stable mountain granite to desert sands subject to erosion by water and wind. Cost of those to be constructed immediately will amount to $10,799,000, and about $8,709,000 of siphon construction will be deferred until water demand warrants it. Article discusses only structural and economic principles governing design of siphons.—*R. E. Thompson.*

Recent Taste and Odors Tests of Paints for Water Tanks. GEORGE L. HALL. Eng. News-Rec., 115: 639, 1935. Brief data are given regarding additional tests (cf. THIS J., 25: 450) of paints made by the Maryland State Dept. of Health. The procedure employed consisted of allowing distilled, tap, and chlorinated water contg. 0.2 to 2.0 p.p.m. residual chlorine to remain in metal vessels coated with the various paints for 15 minutes and then testing the waters for taste and odor, both hot and cold. Nine paints were found satisfactory. The one paint found satisfactory in previous tests and one found suitable in this series have been successfully used in practice.—*R. E. Thompson (Courtesy Chem. Abst.).*

Parasitology and Its Relation to Public Health in Canada. THOMAS W. M. CAMERON. Can. Pub. Health J., 26: 541–7, November, 1935. General discussion. Amebiasis is the invasion of humans by the pathogenic *Endameba histolytica*. Term is not necessarily synonomous with amebic dysentery: in fact, dysentery appears to be one of least common symptoms. Life cycle of *Endameba* consists of vegetative disease-causing stage, spent mainly and normally in large intestine, and resistant cystic stage, which occurs in feces and is infective. So far as is known, man is the only common host. Human infection, accordingly, can be traced only to contamination of food or water with human feces. When numerous serious cases occur in same area, incubation being short, symptoms severe, and liver frequently involved, infection is almost certainly due to grossly infected water supply. This is not uncommon in armies; but only important civil outbreak was that in Chicago. Most common method of infection appears to be contamination of food. Disease is important in North America only because of number of carriers (5 to 10 per cent of population) rather than because of presence of disease.—*R. E. Thompson.*

Pipe Discharge Computed by One Slide-Rule Setting. BENJAMIN C. SEAL. Eng. News-Rec., 115: 822, December 12, 1935. Method of computing discharge from circular pipe flowing full, using polyphase duplex slide-rule, is described. Correction in Eng. News-Rec., 116: 23, January 2, 1936.—*R. E. Thompson.*

What Are the Trends in the Treatment of Water and Sewage? NORMAN J. HOWARD. Eng. Contract Record, 49: 1105–7, 1935. Progress and trends are reviewed.—*R. E. Thompson (Courtesy Chem. Abst.).*

Stream-Gaging Facilitated by Automatic Radio Transmitters. Eng. News-Rec., 115: 579, October 24, 1935. Ten installations of automatic radio transmitters have been made at critical points on California Rivers; some of them have been operating satisfactorily for over 2 years and have proved their reliability and accuracy during that period. They are of most value in flood-control work, giving timely warnings when ordinary means of communication are temporarily disrupted. Equipment is neither complex nor bulky, and can be installed in regulation gage houses. Successful operation is dependent upon automatic keying device on which IRVIN M. INGERSON has applied for patents. Stations operate on wave length of 116 meters with power output of 1 watt, and have distance range of 100 miles. Power is provided by dry cells. Readings are transmitted to 3 significant figures. Transmitter can be energized at 2-, 4-, 6-, or 12-hour intervals and length of time of transmission can be varied from 5 to 45 minutes. Maintenance costs are low. Equipment lowers administration costs; more accurate and frequent information can be delivered to headquarters by this means than in any other way.—*R. E. Thompson.*

Precast Concrete Cribbing for Small Retaining Wall. Eng. News-Rec., 115: 578–9, October 24, 1935. To provide water access from shop and storage yard of Greater Vancouver Water District to deep water for installing and maintaining submerged pipe lines across Burrard Inlet, channel 1800 feet long was constructed. Details given of retaining wall built at end of channel, where floating equipment can be moored. Reinforced-concrete cribbing was selected as most suitable type of construction.—*R. E. Thompson.*

A Review of Water Works and Sewage Activities. A. E. BERRY. Eng. Contract Record, 49: 1102–4, 1935. Projected works in Ontario are outlined.—*R. E. Thompson* (*Courtesy Chem. Abst.*).

National Resources Committee Suggests Extensive Pollution Control Plan. Eng. News-Rec., 115: 480, October 3, 1935. In report issued September 29, it is pointed out that coördination of federal and state agencies appears to be only way in which pollution can be controlled. Any central program should include federal and state agencies and industries contributing to, or affected by, pollution. Six-point program recommended and Potomac River suggested as demonstration project. (See following abstract.)—*R. E. Thompson.*

Nation-wide Control of Water Pollution Proposed. Eng. News-Rec., 115: 505–6, October 10, 1935. More detailed information is given from report referred to in previous abstract. Changes in laws of most, if not all, states are recommended to control water pollution effectively, and following principles are held to be desirable for incorporation in any new legislation. (1) Adequate administrative control. (2) Delegation of power to administrative agency to determine what constitutes pollution prohibited by statute, and to establish limits of pollution. (3) Mandatory power, that is, power to compel installation of suitable works, and to force other appropriate action. (4) Exemption of municipalities with respect to work ordered by administrative

agency from limitation on bonding or taxing power. (5) Power to require provision, through sewerage districts, sanitary districts, or otherwise, of facilities that will enable municipalities and industries to comply with law.—*R. E. Thompson.*

Design of Concrete Mixes for Mississippi River Dams. RALPH P. JOHNSON. Eng. News-Rec., 115: 743-6, 1935. Details are given of the design of the mixes in the construction of 5 locks and 2 dams, involving the placing of 430,000 cubic yards of concrete. The trial-mix method, using the remolding apparatus of T. C. POWERS (J. Am. Concrete Inst., 27: 419, 1932) was employed throughout.—*R. E. Thompson* (*Courtesy Chem. Abst.*).

Valuation Procedure Reviewed by Supreme Court. Eng. News-Rec., 115: 496–9, October 10, 1935. Price indices as sole means of bringing valuation of public utility up to date was condemned by United States Supreme Court in decision rendered June 3 in case brought to test constitutionality of value placed on property of Chesapeake and Potomac Telephone Co. by Maryland Public Service Commission. Court also held that district court which heard case had erred in attempting to set value by deducting company's depreciation reserve from its book cost, adding to difference an allowance for working capital. In rejecting both methods, Supreme Court restated its oft-repeated pronouncement in valuation cases, namely, that all elements of value must be taken into consideration. Extracts from decision and from dissenting opinion by two of the judges are given.—*R. E. Thompson.*

Rainfall in Muskingum Valley Unusually Heavy in August Storm. Eng. News-Rec., 115: 689, November 14, 1935. Additional data on unusual storms in south-central Ohio on August 6 and 7, which caused worst floods since 1913, are given, together with isohyetal map based on records of Weather Bureau. Although the 8.7 inches of rain recorded at Newcomerstown in 24 hours exceeded previous official maximum in Ohio of 7.4 inches, yet it was considerably less than actual rainfall in neighboring areas. Precipitation of 8 inches or more, with unknown maximum in excess of 12 inches, occurred over area of about 500 square miles. Ground storage had been reduced by previous rainfalls and previous maximum stages were exceeded in practically all streams having watersheds of less than 300 square miles.—*R. E. Thompson.*

Diarrhea and Typhoid Infections. ELIZABETH CHANT ROBERTSON. Can. Pub. Health J., 27: 37–41, 1936. Water-borne epidemics of typhoid fever are almost invariably preceded by much more widespread outbreaks of gastro-enteritis. It is generally held that early enteritis renders the individual more liable to develop typhoid fever, although very few reports definitely state whether typhoid patients suffered from early disturbance. It has also been claimed that gastro-enteritis protects the individual from typhoid infection. The present report provides additional evidence in favor of the latter hypothesis. Although the correlation is not perfect, it would appear that individuals who show immediate reaction (gastro-enteritis) rarely if ever develop typhoid and vice versa, that those who develop typhoid do not suffer any upset soon

after ingestion of the causative agent. It is possible that immediate gastro-intestinal reaction prevents the invasion and setting up of severe infection by typhoid bacilli. Biblilgraphy of 14 references.—*R. E. Thompson* (*Courtesy Chem. Abst.*).

Earthfill Dam To Be Built by Method of Soil-Compaction Control. Eng. News-Rec., 115: 807, December 12, 1935. Contract recently let by Metropolitan Water District of Southern California for 194-foot Cajalco Dam, near Riverside, is first for large dam to be built by PROCTOR method of soil-compaction control (cf. Eng. News-Rec., August 21, September 7, September 21, and September 28, 1933). Of 6 bids, 5 were within range of $4,647,000 to $4,883,000. Future raising of dam by 46 feet is contemplated in design. In ultimate dam, downstream third is to be pervious fill and upstream two-thirds compacted fill. Almost entire yardage in present contract is tightly compacted material, only small toe section being pervious fill. Reservoir, which will be used for storing water from Colorado River aqueduct, about 60 miles from center of Los Angeles, will have initial capacity of 100,000 acre-feet and ultimate capacity of 225,000 acre-feet.—*R. E. Thompson.*

NEW BOOKS

Sedgwick's Principles of Sanitary Science and Public Health. SAMUEL C. PRESCOTT and MURRAY P. HORWOOD. Cloth; 6 × 9 inches; pp. 654. New York: The Macmillan Co. $4.25. Reviewed in Eng. News-Rec., 115: 442, September 26, 1935.—*R. E. Thompson.*

Surface Runoff Phenomena. Part I. Analysis of the Hydrograph. Publication 101, Horton Hydrological Laboratory, Voorheesville, N. Y. Paper; 6 × 9¼ inches; 73 pp.; litho-printed. Ann Arbor, Mich.: Edwards Bros., Inc. 75¢. Reviewed in Eng. News-Rec., 115: 615, October 31, 1935.—*R. E. Thompson.*

The Chemistry of Cement and Concrete. F. M. LEA and C. H. DESCH. Cloth; pp. 429. London: Edward Arnold and Co. New York: Longmans, Green and Co. $9.50. Reviewed by P. H. BATES in Eng. News-Rec., 115: 615, 1935.—*R. E. Thompson.*

A Comprehensive Treatise on Engineering Geology. CYRIL S. FOX. Cloth; 6 × 10 inches; pp. 392. London: The Technical Press, Limited. New York: D. Van Nostrand Company, Incorporated. $7.50. Reviewed in Eng. News-Rec., 115: 895, December 26, 1935. Includes several chapters on water supply. —*R. E. Thompson.*